Kodak

COLOR
DATA BOOK
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color photography

OUTDOORS

SECOND EDITION

COLOR PHOTOGRAPHY OUTDOORS, extensively revised in this Second Edition, is a book for advanced and professional photographers. In addition to complete discussions of variations in daylight color quality, controlling lighting contrast outdoors, filters for use in daylight, and critical exposure of films, this Data Book contains a number of practical suggestions, in many cases with photographic examples, for a variety of outdoor picturemaking situations.

How the Cover Photograph Was Made

The cover photograph, by David W. Cherrington, was made to illustrate an Arden Formals creation of Eastman Chromspun, manufactured by Eastman Chemical Products, Inc. Cherrington used Kodak Ektachrome Film, Daylight Type, and a 127mm, f/4.7 Kodak Ektar Lens on a 4 x 5 view camera.

Camera and subject were located in the shade of the wall and trees; the subject was back lighted by summer noonday sun. A 200-watt-second electronic flash unit with an effective candlepower-seconds output of 6300 provided fill-in illumination. The reflector was removed to decrease the fill-in light. Located at the camera, the electronic flash unit was 15 feet from the subject. Test exposures on black-and-white film permitted Cherrington to evaluate the amount of fill-in illumination received with and without a reflector, as well as at different distances.

COLOR PHOTOGRAPHY OUTDOORS

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SECOND EDITION—Second Printing, 1962

This punching fits the *Kodak Color Handbook*. See your Kodak dealer.

THUMB INDEX

color photography

OUTDOORS

WITH *a scene of natural beauty before his camera, and with favorable natural lighting conditions, the beginner often snaps a color picture which would do credit to an experienced photographer. But making color pictures of consistently professional quality requires knowledge and the skill to apply it, particularly if a variety of subject material must be photographed for a variety of purposes.*

The making of top-flight color pictures outdoors thus presents a challenge to the photographer. The direction, intensity, and color quality of the illumination vary considerably from hour to hour and from day to day. And, as a result, the photographer must either find a way to utilize the existing illumination or wait until the conditions are more favorable.

To meet this challenge, the photographer should be familiar with the two principal problems of outdoor color photography—the variations in the color quality and in the lighting contrast of daylight illumination. This Data Book is intended to help the reader understand the photographic consequences of the different daylight conditions and, by applying basic principles to specific picture-making situations, realize the full potentialities of the color films he uses.

NATURAL OUTDOOR LIGHTING

DAYLIGHT COLOR QUALITY

EACH color film is designed for exposure with a light source of a particular color quality. By color quality is meant the relative proportions of light of the various colors, such as blue, blue-green, green, yellow, orange, and red, present in the source. Daylight color quality on a clear day consists of approximately equal quantities of these various colors reaching the subject from the sun and sky. Daylight Type color films are designed or balanced in their manufacture to produce pleasing results in open sunlight on clear days. Departures from this color quality may produce a photograph in which the colors differ from their visual appearance at the time the exposure was made.

Outdoors on a clear day, there are actually two sources of illumination, the light arriving directly from the sun and the blue light from the sky. These two sources, which constitute "daylight illumination," are separate and distinct on a clear day but are fused and combined into one source on an overcast day.

Variations in Color Quality

The color quality of daylight is by no means constant. A change in the color of either sunlight or skylight, or a change in the relative amounts of the two sources, changes the combination falling on the subject.

Time-of-Day Changes. During the hours shortly after sunrise and just before sunset, more scattering of sunlight takes place than at other times of the day because of the greater distance the direct rays must travel through the atmosphere. The light is not only less intense but also deficient in blue, which is scattered most, and to a lesser extent, deficient in green. Pictures made by light of this quality have a warm cast in the areas receiving direct sunlight. At the same time, the shadows tend to be abnormally blue. The results may be satisfactory if they are appropriate to the subject material and the purpose of the picture. On the other hand, the rendering of sunlit areas cannot be corrected by the use of a filter without making the shadows still bluer. Since there are two light sources involved—sun and sky—it is not possible for a filter to correct for both.

As a general rule, the color balance of a photograph tends to be definitely warm when the sun is less than 15 or 20° above the horizon. Unless the sun is only a few degrees above the horizon, the warmth of the light is not particularly noticeable in viewing the scene, but the

Although photographs made on clear days show brilliant, saturated colors, the shadows on the model's face (see left photo on next page) are so harsh as to require fill-in illumination for pleasing results. A reflector setup, depicted at right, produced the picture at far right. Reflectors have the advantage over fill-in flash in that effects of reflected light on the model can be scrutinized and altered as desired.

Either blue flash bulbs or electronic flash can be used outdoors for fill-in light. Off-the-camera flash, as shown in setup picture at right, provides better modeling. The flash should reduce the objectionable shadows produced in the left picture on the next page, but it should not destroy the natural sunlit appearance of the picture. Photo at far right retains a natural look, but without hard shadows.

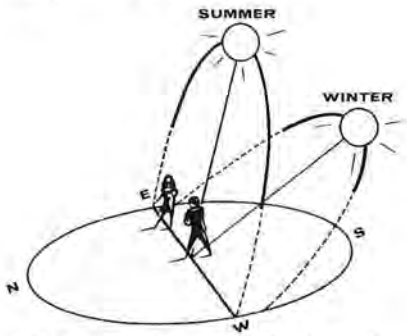
Hazy sun is ideal for fashion photography. The light haze reflects sunlight into shadow areas, and fill-in illumination is therefore rarely necessary. Although colors tend to be less brilliant and saturated than on clear days, they retain a desirable sparkle and a sufficiently vivid appearance. The exposure on hazy days is usually the same as it is on clear days; only the lighting ratio is reduced. The haze cuts the brightness of the sun while it increases illumination from the sky. Hazy sun, without fill-in illumination, lighted the photograph at left on the next page.

On cloudy days, such as the one on which the photograph at far right was made, sunlight and skylight are combined into one diffuse light source. Pictures have a flat appearance because there are no shadows or sunlit highlights. The lighting is bluer and may require a Kodak Skylight Filter for improved rendering. Squinting eyes are not a problem on overcast days; in the other color pictures, side lighting was used to reduce squinting, as well as enhance modeling. These pictures were made by Peter Gales, Eastman Kodak Company. Reproductions are from Ektachrome transparencies.






photographic effect is nonetheless marked. During the winter months in the northern latitudes, there are fewer hours of daylight, and the color of the light is normal for a smaller part of the time.



The hours during which pictures with normal color balance can be obtained in the northern latitudes are represented by the solid portions of the two arcs. The greater length of the dotted portion of the winter arc shows how the sun takes longer to reach an angle of approximately 20° above the horizon.

Hazy Sun. The two separate sources of illumination, the light from the sky and that from the sun, which fall on the subject on a clear day become less different when haze or clouds are present. Large white clouds or a light haze tends to reflect the sunlight into the shadow regions, lightening them and minimizing the bluishness which is normal when they are illuminated only by clear blue sky. Hazy lighting is ideal for most outdoor fashion and illustrative shots.

Overcast Conditions. On a completely overcast day when the lighting is such that no distinct shadows are cast, the two sources are effectively combined into one large, diffuse source. The absence of shadows or of sunlit highlights gives a characteristic flat appearance to the pictures. This flatness is emphasized by the low color saturation created by the diffuse lighting. The color quality of the lighting is somewhat bluer than normal daylight illumination on a clear day. However, it is not possible by the use of corrective filters to reproduce the character of the lighting in a photograph made on a sunny day.

Open-Shade Conditions. Subjects photographed in open shade on a clear day are shielded from the direct rays of the sun and illuminated only by blue skylight and reflected light. Thus photographs of people taken on the shaded side of a building appear to have an over-all bluish cast, particularly noticeable in flesh tones. Shadow areas in subjects which are in direct sunlight but strongly side- or back-lighted are also bluish. This effect is particularly noticeable in snow scenes and pictures of light objects, such as white houses. The degree of bluishness depends on the depth of color in the sky, the presence or absence of clouds to act as reflectors, and the degree of clarity of the atmosphere. Early or late in the day, the effect of the skylight is more pronounced because the intensity of the sunlight drops relative to that of the skylight.

Geographical and Altitude Changes. Certain areas are noted for an ever-present haze or slight fog, others for extremely clear atmospheric conditions. The conditions, however, and not the location are pertinent. The problems of making a photograph on a typically hazy day in, say, Bermuda, and on a slightly hazy day in New York are practically the same. In the same way, a clear day in New York and a clear day in the southwest United States yield photographs of similar color balance, provided no other factors influence the results.

Measurements made all over the world have shown that, under the same atmospheric conditions and with the sun at the same elevation in the sky, the intensity of illumination is practically constant, regardless of geographic location or time of year. The differences in photographic results in the various parts of the world are usually due to variations in the reflectance of the subject and the lighting-contrast differences peculiar to that region. These effects are discussed on page 55.

Because of the increased clarity of the atmosphere, distant scenes at high altitudes are more clearly and sharply rendered than similar scenes at lower levels. Above 5000 feet, atmospheric scattering of light of all colors is decreased and the sky becomes a deeper blue. The increased blueness of the sky tends to make shadow regions in close-ups appear darker and bluer.

LIGHTING AND SUBJECT CONTRAST

ILLUMINATION outdoors on a clear day can be compared, in a general way, to the main and fill-in lights used in studio work. The sun, of course, corresponds to the raw, undiffused, high-intensity main light, and it accounts for a large proportion of all the light falling on the subject. The sky can be compared to the large, diffuse fill-in lights used for general illumination. The intensity of light from the sun is relatively fixed, but skylight varies over wide limits. The relative amounts depend upon the area of the sky open to the subject, the presence or absence of clouds, and the amount of haze.

Illumination Level and Contrast Variations

On a perfectly clear day when the sky is a deep blue, the illumination from the sun, measured on a plane perpendicular to the rays of the sun, is approximately 9000 to 9500 foot-candles. In addition to this amount, approximately 1500 foot-candles are provided by the blue skylight, or a total of 10,500 to 11,000 foot-candles of illumination in the sunlit regions of the subject. Thus for a subject receiving light from a large unobstructed sky area, the lighting ratio is approximately 7:1. When the sky is completely overcast and the sun is obscured, all of the light

falling on the subject arrives from the sky. Although the illumination level may reach a value as low as 200 foot-candles under conditions of dense clouds, the light is almost uniform over most of the subject. As the main light (sunlight) decreases in intensity (because of an increase in the haziness of the sky), the relative strength of the fill-in source increases. The highest contrast for subjects not shaded by surrounding objects is obtained with clear sky and bright sun.

The lighting contrast on any particular subject depends upon the placement of the subject with respect to its surroundings and the direction of the lighting, as well as upon the existing sky and atmospheric conditions. In actual practice, the lighting ratio may be very great indeed, particularly if the shadow region is shaded from the sky by near-by objects and is receiving only light reflected from the surroundings. Owing to the presence of lens flare, the maximum lighting contrast in a camera image of a scene is usually much less than the actual ratio of illumination in shadow and highlight areas of the subject.

Shadow areas reproduce relatively darker in the photograph than they appear to the eye. The eye cannot be relied upon as a means of evaluating lighting contrast. To prevent the reproduction of shadow detail from being unpleasantly dark, more light is usually added to the shadows than visually appears necessary.

Subject-Contrast Variations

The different quantities of light reaching the film from various parts of the scene depend upon two separate factors, the reflectances of the subject material and the amount of light reaching each region in the scene from the main and the fill-in lights, and from the surroundings by reflection. Although the average reflectance of an outdoor scene is about 12 percent (see "Use of Test Cards," page 53), some areas, such as sand, flesh tones, and yellow flowers, reflect a great deal of the light, whereas such areas as dark green foliage, dark-colored clothing, and dark buildings reflect very little of the light reaching them. The ability to reflect great or small quantities of light is obviously a characteristic of the subject material itself. The amount of light reaching various parts of the scene in the shadows and highlights varies considerably and is usually expressed as a ratio of highlight to shadow illumination. These two factors—the reflectance range of the subject and the lighting-contrast ratio produced by the light source—control the subject contrast, or, as it is frequently called, the brightness range.

For any particular subject, the reflectance ratio of the subject material itself cannot be altered readily. A change in the subject contrast can be produced only by changing the other variable, lighting contrast.

CONTROLLING LIGHTING CONTRAST

COLOR PHOTOGRAPHS of distant landscapes usually reproduce best when they are made by the brilliant lighting of a clear day and the photographic result is not too contrasty. On the other hand, the soft light of a hazy day tends to produce the best lighting for close-ups, without the need for supplementary illumination. The subject brightness range, which is the direct result of the various reflectances of the subject and of the lighting contrast, should be held within the rather close limits set by the fixed scale of the color material. In order to stay within these limits, the appropriate lighting conditions should be selected or supplementary illumination provided when close-ups are made.

There are times when the photographer will prefer to exceed the commonly recommended lighting ratio of 2:1 or 3:1 for color films in order to create a particular effect. For example, the halo around the hair in a back-lighted portrait can be emphasized by keeping the lighting ratio high. Ratios as high as 8:1 are sometimes used. Desirable ratios depend somewhat upon the use to be made of the photograph. For example, color pictures which are to be reproduced by photomechanical methods should usually be made with low lighting ratios.

EFFECTS OF LIGHTING ON COLOR SATURATION

THE colors in a photograph made on a clear day tend to be more saturated and brilliant than those made by the diffuse light of a cloudy or overcast day. For example, soft, pastel colors in a model's costume tend to be grayed down and to lose their characteristic appearance when the sky is not clear. This effect is more pronounced as the distance from the camera to the subject is significantly increased. If photographs must be made under such conditions, the colors selected for use in the scene should be more saturated so that the reproduction may be pleasing.

On a clear day, the light from the sun is specular, or highly directional. Any surface reflections from colored objects can be directed away from the camera by proper placement of the camera and the subject with respect to the sun. The color of the light from these surface reflections tends to be that of the light source, i.e., white, because the light has not penetrated beneath the surface of the colored material and so has not been colored by the dyes or pigments of which the coloring material is composed. Being white, this surface-reflected light, which may constitute a good proportion of all the light reflected from the subject, desaturates the depth or body color of the subject itself. On a cloudy day,

with the light from the sky (the sole light source) reaching the subject from all directions, it is impossible to orient the subject in such a way that surface-reflected white light can be directed away from the camera. Loss of color saturation results.

USE OF DIFFUSE LIGHT

THE one factor which probably exerts the greatest influence on the final results in outdoor work is the kind of day on which the photograph is made. Soft, diffuse lighting is preferable for close-ups of models and for other shots in which both the shadow regions and the regions directly illuminated by sunlight must retain detail. The light is soft and diffuse when the direct rays of the sun are scattered by an atmospheric veil or haze. Shadows cast by objects in hazy sunlight are soft and indistinct in their outline, and lighter in comparison to the highlights than when the sky is perfectly clear. The color saturation is lower than under more contrasty lighting but still sufficient for a pleasing reproduction of the color characteristics of the original. When there is a thick veil or overcast, the lighting is even softer, with the result that modeling and shadows disappear, and the resulting photograph appears flat and without sparkle or life. This appearance may, however, be the very mood which the picture must create; if so, an overcast day should be chosen and the properties in the picture, which contribute to that appearance, carefully selected.

One way of controlling the specularity of the illumination is to set up a large, white, cheesecloth screen in such a position that the light falling on the model is diffused. Thus the shadow lines will be softened, and the highlights subdued. If head-and-shoulder close-ups are being made, a small screen, about 2 or 3 feet across, covered with cheesecloth, and mounted on a stand or boom, can be located between the sun and the model. It is important that the background be kept out of focus, or a plain background be used, so that the lack of diffusion of the sunlight on the background will not be evident. Increased amounts of diffusion, with a consequent decrease in illumination on the subject, can be obtained by the use of additional layers of cheesecloth.

USE OF REFLECTORS

WITH side- and back-lighted subjects, particularly, lighting contrast can be effectively reduced by the use of reflectors. Any surface which redirects light onto the subject acts as a reflector. Reflectors have the advantage over supplementary-flash illumination that the effect of the reflected light can readily be seen on the subject and on the ground glass of the camera. Thus it is possible to experiment before actually

making the photograph. A reflector which is neutral should be selected, unless for some reason it is desirable for the shadow areas to take on a cast of color from the reflector. On a hazy or overcast day, the need for a reflector seldom exists.

Natural Surroundings

Natural surroundings, such as walls or structures painted a light gray or white, serve as reflectors. Snow directs a great amount of light back into all areas of the subject in a very diffuse fashion, helping to lighten shadows and to reduce contrast in various parts of the subject. Beach scenes, even though made on a clear day in open sunlight, can retain considerable detail and transparency in the shadows because of the high reflectance of the sand. Large white clouds in a clear blue sky also serve as reflectors or secondary light sources to lighten the shadows appreciably. Use should be made of these natural surroundings wherever possible, although best results frequently require the use of one or more reflectors or flash lamps to add light in areas of the subject not affected by reflective surroundings.

Polished Reflectors

The greatest amount of reflected light is provided by a polished metallic reflector or a mirror. This type of reflector is used, at a considerable distance from the subject, primarily to illuminate dark backgrounds, such as a tree trunk, bricks, or green foliage, in order to gain separation between the subject and the background. Care must be taken with this type of reflector, because the intensity of the reflected light is only slightly less than that of the sun itself, and sharp shadows may, therefore, be cast. It is also impossible for a model to look directly at such a reflector without squinting. Furthermore, the area of concentrated light which is provided by a polished reflector is small and creates the danger of a "hot spot" on one part of the subject.

Aluminum-Foil Reflectors

A slightly softer type of fill-in is provided by an aluminum-painted projection screen or by aluminum foil which has been crumpled and then flattened out, and finally mounted on cardboard. This type of reflector also directs a good proportion of the light in one direction, but in a more diffused manner, without casting sharp shadows as a mirror does. To be effective, it should be placed at a distance from the subject which is no greater than approximately four times its width. For head-and-shoulder portraits, a reflector which is only about 2 feet square can be used.

Reflectors are frequently placed on the ground or propped up against a camera case. Under these conditions, the low angle of the reflected light creates an unnatural type of lighting. To avoid this difficulty, the reflectors should be mounted on stands which will support them at least on a level with the subject's head. A good rule is that the reflector should be located, with respect to the subject and the camera, in a position similar to that used for the location of lights for pictures made in the studio.

There may be instances when much of the subject is illuminated by blue skylight and yet a warm color balance is desired in the flesh tones. One means of obtaining this effect is to use as a reflector crumpled gold-colored aluminum foil mounted on a sheet of cardboard. This foil is used for window-display decorations and is available through decorators' suppliers or from art-materials supply houses. As a matter of convenience, the gold foil can be mounted on one side and the aluminum foil on the other side of the same sheet of cardboard. Care should be exercised in the use of such reflectors to avoid excessive warmth. If only a part of the reflector is covered with gold foil and the rest with aluminum foil, the effect of warmth produced is not so great.

The increased illumination contributed by reflectors is usually visible both on the ground glass of the camera and by viewing the subject directly. However, to make the reflected light more apparent for the purpose of aiming the reflector, a small mirror can be attached temporarily to the large reflector and used for positioning purposes, then removed before the exposure is actually made.

Matte Reflectors

A very diffuse type of reflector can readily be made from white paper, white cardboard, composition board painted with a flat-white paint, or white sheeting. In an emergency, even a newspaper will serve. Such matte surfaces reflect light in all directions and are useful only when conditions permit holding them quite close to the subject. These reflectors are really effective only at distances no greater than their own width. The use of matte-surface reflectors is consequently limited. When their use is feasible, however, the resulting soft and uniform lighting leads to pleasing results in the color pictures.

Reflectors are not always the most convenient and desirable means of changing the lighting ratio. The chief disadvantages of reflectors are their size and the necessity of having an assistant or standards to hold them in place at some fixed angle. When a reflector is placed to one side in order to get it out of the picture area, objectionable secondary shadows are sometimes created.

USE OF FILL-IN FLASH

BLUE flash bulbs or electronic flash may prove to be a more convenient source of supplementary illumination than reflectors, even though the batteries, flash reflectors, and stands (if used) must be transported. Like blue flash bulbs, most portable, low-voltage electronic flash units provide fill-in illumination which approximates the color quality of daylight. In color-film instruction sheets, any filters recommended for use with electronic flash can be ignored if the electronic flash provides only fill-in illumination outdoors.

The additional illumination furnished by flash should not create noticeable secondary shadows, but should be aimed in such a way that the natural sunlit appearance of the scene is retained in the photograph. To reproduce the visual appearance of the scene at the time the photograph is taken, it is important to establish a suitable balance between the light from the sun and the light provided by the flash. Excessive supplementary illumination, or "overflashing," creates an artificial and unreal effect, and should be avoided unless such an effect is wanted for a special purpose. Flash reflectors are frequently mounted directly on the camera as a matter of convenience. The press photographer must use the camera and light source as one unit in order to take his pictures with a minimum of delay. The amateur, too, usually keeps his flash equipment mounted on the camera, although separate, off-the-camera operation with an extension unit and cord provides more modeling in the pictures. More flexibility is needed for illustrative work, because the illustrative photographer must make every effort to produce the best possible rendering of the subject material he is called upon to photograph. The reflector is usually mounted on a stand which is separate from the camera. With a sufficiently long cord, the flash unit can be positioned independently of the camera location.

Since flash reflectors must often be used at considerable distances from the subject, bringing the light to the subject at the proper angle may require a stand that can raise the reflector to a height of 8 or 10 feet. Suitable lightweight stands are available from suppliers of photographic equipment designed for professional use.

Placement of Supplementary Lights

The problem of locating flash reflectors to provide supplementary illumination for outdoor color illustrations and the problem of locating lights for a studio portrait are very similar. Perhaps the principal difference between the two conditions is that the sun, the main light source outdoors, occupies a fixed position with respect to the scene at any given time, and either the subject must be placed relative to the

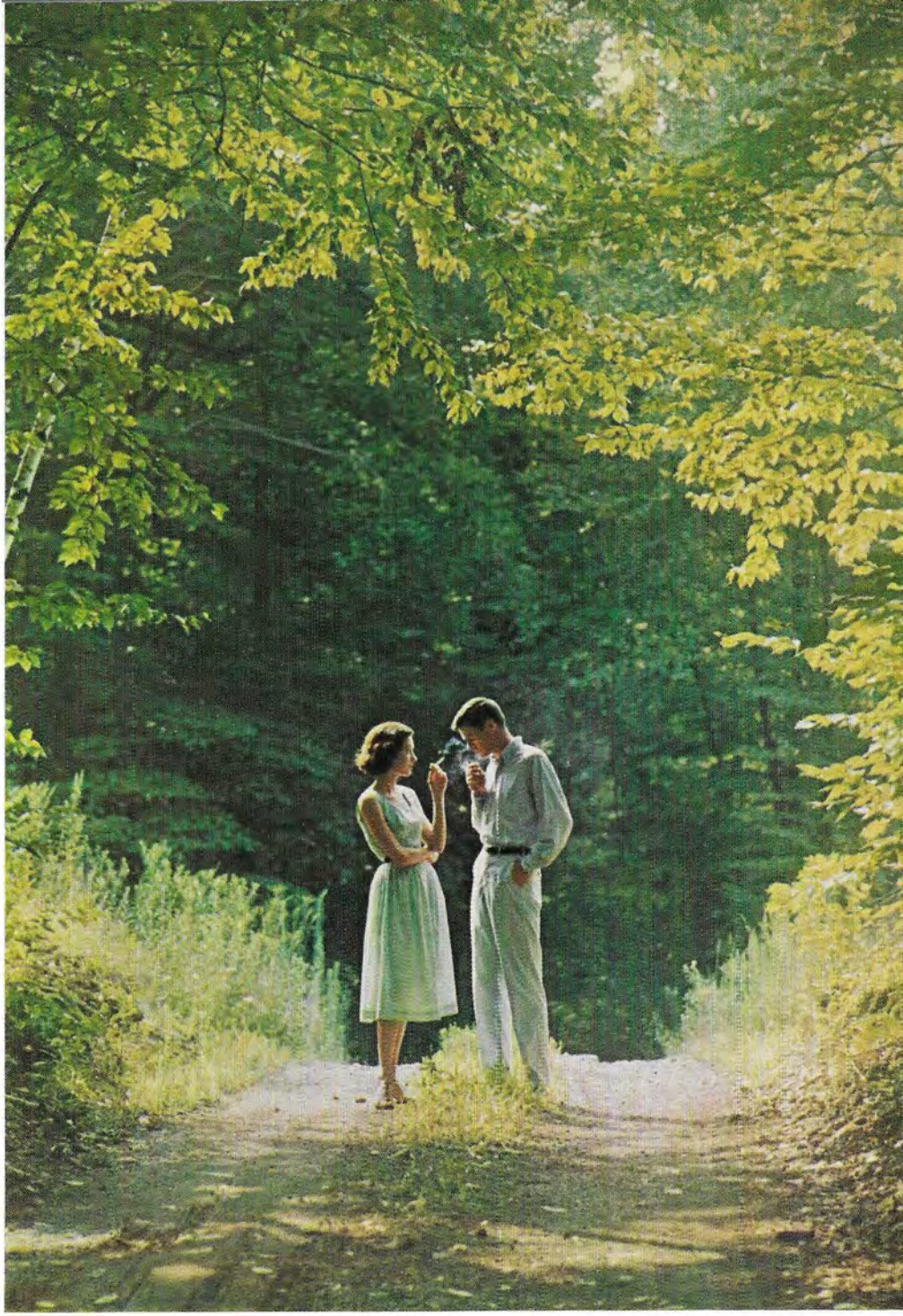
position of the sun or the photographer must wait until the sun is in a suitable position. The making of most portraits in the studio requires the use of two, and frequently three, lights: a main light; a fill-in, or supplementary, light; and, in some cases, a back light to pick up highlights in the hair. In outdoor work, the lighting problem is essentially the same. The sun takes the place of one light; the others, whether flash or reflector, should be so located that, together with the sun, they produce the proper lighting on the subject. The following instructions apply whenever the best possible picture quality is needed.

Lighting Ratio. When blue flash bulbs are used for fill-in illumination, the supplementary flash tables in the Data Sheets in the Data Book *Kodak Color Films* lead to suitable lighting ratios under average sunlight conditions and with typical flash reflectors. The Fill-in Flash Computer in the *Kodak Master Photoguide* provides data for supplementary illumination with electronic flash.

As has been pointed out in the discussion of outdoor lighting and subject contrast, the lighting contrast from sunlight is affected by: (1) sky conditions (clear, hazy, or overcast), (2) extent of the sky area contributing light to the shadows, (3) presence of natural reflectors (buildings, sand, and white clouds), and (4) the sun elevation and direction of the light as it reaches the subject. Average outdoor lighting ratios are around 6:1; extremely harsh lighting, such as top or cross lighting on a very clear day, with dark surroundings produces a ratio of 8:1 or 10:1; soft lighting, such as may occur in beach and snow scenes and scenes in the vicinity of light surroundings, gives a ratio as low as 4:1. Compensation should be made when the lighting ratio is low by moving the lamps back or by using a diffuser over the reflector. Actually, no supplementary illumination may be required under such conditions unless the subject is a close-up. When the lighting ratio is high, more shadow illumination should be provided by moving the lights closer. In order to double the amount of flash illumination, divide the distance by a factor of 1.4; to halve the flash illumination, multiply the distance by 1.4. One thickness of clean white handkerchief draped over the flash reflector also reduces the illumination by about half.

The actual lighting ratio existing in the scene can be measured with an exposure meter, either directly with an incident-light type or indirectly with reflected-light readings from a test object, such as the gray (18 percent reflectance) side of the Kodak Neutral Test Card. The use of both incident- and reflected-light meters, as well as the use of test

One predominant color creates a forceful mood for this advertising photograph by Arik Nepo. The reproduction is from a print on Kodak Ektacolor Paper made from a Kodacolor negative 120. The advertising agency was William Esty Company; the art director, William Strosahl.

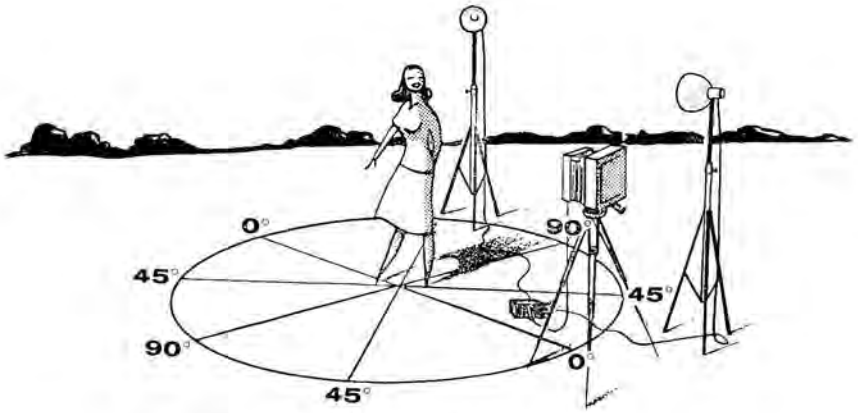


cards, is explained in the section on page 49—"Use of Photoelectric Exposure Meters."

Side Lighting of a model means that approximately one-half of the face is illuminated by the sun. The illumination on the rest must be increased by supplementary fill-in illumination. For a full-face shot of a side-lighted subject, the position of the sun is approximately at right angles to the camera-subject axis; when the angle becomes about 45°, the lighting is called "three-quarter lighting" since about three-quarters of the face is directly illuminated by the sun. The problem of placing the supplementary illumination is about the same in both types of lighting.

For side-lighted subjects, the sun constitutes the main light, and a single flash unit, the fill-in light. The flash should be located at subject height, close to the camera, and on the side opposite the sun. For results of highest quality, a second flash unit can be added about 3 or 4 feet away from the subject to serve as a back light. This second light highlights the hair and creates an attractive gloss or sheen. Undesirable secondary shadows may be cast on the forehead if the flash is moved too far forward over the top of the head from its normal position above and in back of the head. One possible arrangement of the two lights for subjects which are illuminated from the side by the sun is shown in the diagram below.

The exposure depends primarily upon the level of daylight illumination and can be determined by reference to the exposure table on the instruction sheet packed with the film or by the use of an exposure meter. Lens and shutter combinations which give the same daylight

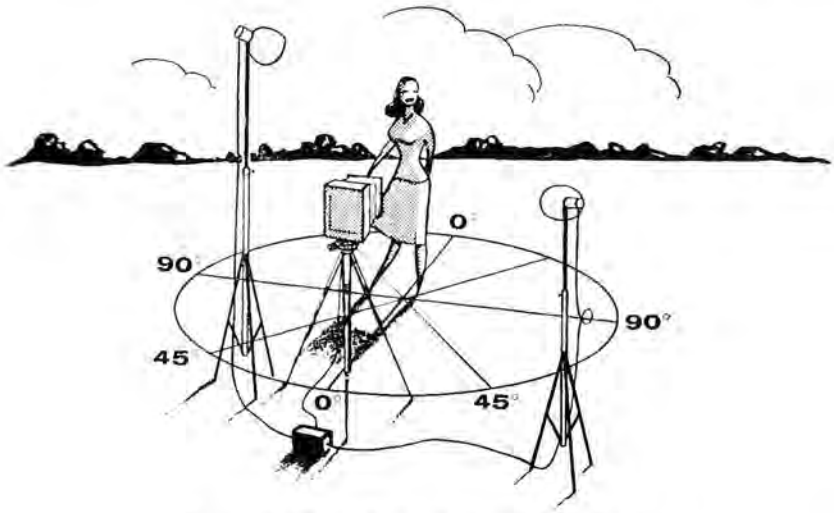


Placement of flash reflectors for side-lighted subject.

exposure give varying amounts of blue flash-bulb exposure. Hence the choice of shutter time and lens opening gives a choice in bulb-to-subject distance range. This choice does not apply to supplementary lighting from electronic flash. No exposure increase for side-lighted subjects need be given, since the fill-in illumination insures satisfactory shadow detail.

Early in the morning or late in the afternoon on a clear, sunny day, the amount of the main illumination provided by the sun is less than in the middle of the day, as can be verified by exposure-meter readings. When supplementary flash is used at these times, the lamps should be moved back so that the lighting contrast on the subject will not be reduced to too low a value. For example, late in the day when the illumination from the sun has decreased to the point where an increase of 1 stop in exposure is necessary, the lamp-to-subject distance should be increased by about 1.4 times.

Back Lighting. Two flash units are usually needed with this type of lighting in order to eliminate any tendency toward flat lighting, and also to provide roundness and a separation of the planes in the face without the creation of obvious secondary shadows. The main light should be placed at one side of the camera and between 2 and 4 feet above the subject level. It should be located approximately on the extension of a line from the sun through the subject. This light is the counterpart of the light used in studio portraiture to create a triangular



Placement of flash reflectors for back-lighted subject.

highlight on the opposite cheek. The second, or "broad," light is used at the subject level, on the other side of the camera from the main light and about twice as far from the subject. The general lighting arrangement is shown in the diagram below. As in the case of side-lighted subjects, no exposure increase is required by the nature of the lighting, because the supplementary illumination insures adequate shadow detail. **Hazy days** require supplementary illumination if the lighting ratio is still so high that fairly strong shadows are cast. The location of the lights should be much the same as on a clear day. Because of the somewhat smaller quantity of direct light from the sun, and the lower lighting ratios, the flash distances can be as much as double the normal. **Dull days** sometimes have to be used for making outdoor photographs, even when the appearance of sunlight is needed in the reproduction. With considerable care and skill, it is possible to simulate sunlight under such conditions by providing a set of lights for each principal object in the scene. As the illumination from each bulb falls off with distance, the next set of lights picks up the illumination for another part of the picture.

The lights which are to create the shadows from the simulated sun should be arranged first, even before the subject is placed in position. The principal parts of the subject, such as each figure and each important large object, must be illuminated with the lights so oriented that the shadows will all be cast in the same direction. The subject is then placed in position, and the separate fill-in lights are located to provide the proper amount of supplementary illumination. As an example, if the illustration includes two models located some distance apart, a main light and a fill-in light must be used on each one of the models. Lights can be included in the picture area if they can be concealed behind sufficiently large objects within the angle of view of the camera and if the light from them does not fall on objects immediately adjacent to them. In such a setup it may also be necessary to add light on the background. Even though several lights may be used for photographs under dull daylight conditions, the arrangements are not necessarily complex, although setting them up may be time consuming, because the same lighting pattern is used in each part of the photograph.

In this advertising photograph by Jon Abbot, the pervasive serenity of dawn was captured on Kodacolor Film 120. The reproduction is from Abbot's print on Kodak Ektacolor Paper. Batten, Barton, Durstine and Osborn, Inc., was the agency; Victor Capellupo, the art director.

FILTERS

Most filters designed for use in exposing color materials are much less saturated in color than those intended for black-and-white films. Whereas filters for black-and-white films are generally designed to cut out whole sections of the color spectrum, filters for color correction are designed to accentuate one particular color or another. Because only slight changes in color balance are usually necessary, the unsaturated colors are all that are required.

Although not a filter in the customary sense of the word, the Kodak Pola-Screen is used in a similar manner; under the proper conditions, its effect is to darken the blue sky and, to a limited extent, to penetrate light-blue haze. The Kodak Skylight Filter is used to avoid excessive bluishness when the film is exposed under open shade or overcast conditions. The Kodak Wratten Filters No. 85, No. 85B, and No. 85C are used when films balanced for artificial light are exposed with illumination of daylight quality.

FILTERS FOR COLOR-NEGATIVE FILMS

To facilitate color printing, it is desirable that the color balance of color negatives be reasonably uniform. Therefore, advance compensation for differences in exposing sources should be made by placing an appropriate filter over the camera lens. For example, in the case of Kodacolor Film, exposure recommendations are aimed at clear-flash balance. If the film is exposed by daylight illumination, a filter, such as the Kodak Wratten No. 85C, should be placed over the camera lens, even though no filter is recommended for general amateur use in daylight. Use of this filter will make daylight-exposed negatives of similar color balance to clear flash-exposed negatives. Consult the film instructions for filter suggestions to be used with Kodak Ektacolor Films and various exposing sources.

FILTERS FOR DAYLIGHT TYPE FILMS

In general, filters need not be employed with Daylight Type films exposed under ordinary conditions of bright sunlight. The bluish reproduction of light haze in distant scenes is similar to its visual appearance. However, there are instances, particularly with photographs made in open shade, in which blue skylight contributes a large proportion of all the light illuminating the subject, and a correction filter is necessary for best rendering. The most serious problem here is the

reproduction of flesh tones. The effect of off-balance illumination is apparent, particularly in the rendering of these relatively unsaturated colors, which are usually among the most important colors in the picture.

Kodak Skylight Filter. Experience has shown that a filter which absorbs only ultraviolet radiation produces little effect on the film. A filter which absorbs only blue light in addition to the ultraviolet radiation generally produces a greenish cast over the distant haze and in areas of the picture illuminated by blue skylight. Actually, the light from the sky consists of all colors, with considerable blue light and some green predominating. The Kodak Skylight Filter is designed to absorb ultraviolet and a small proportion of blue and green light. These absorptions account for its pink color.

This filter is designed primarily for use in open shade under a clear blue sky to produce a noticeable improvement in color rendering when pictures made without a filter would be too bluish. However, use of this filter under less blue conditions does not usually result in an appearance of overcompensation, since the eye is tolerant to the warmer tones produced by the possibly excessive filtering.

When films balanced for artificial light are used under bluish daylight conditions, the Skylight Filter is not needed, because the conversion filter absorbs enough of the excess ultraviolet and blue light.

FILTERS FOR ARTIFICIAL-LIGHT FILMS WITH DAYLIGHT

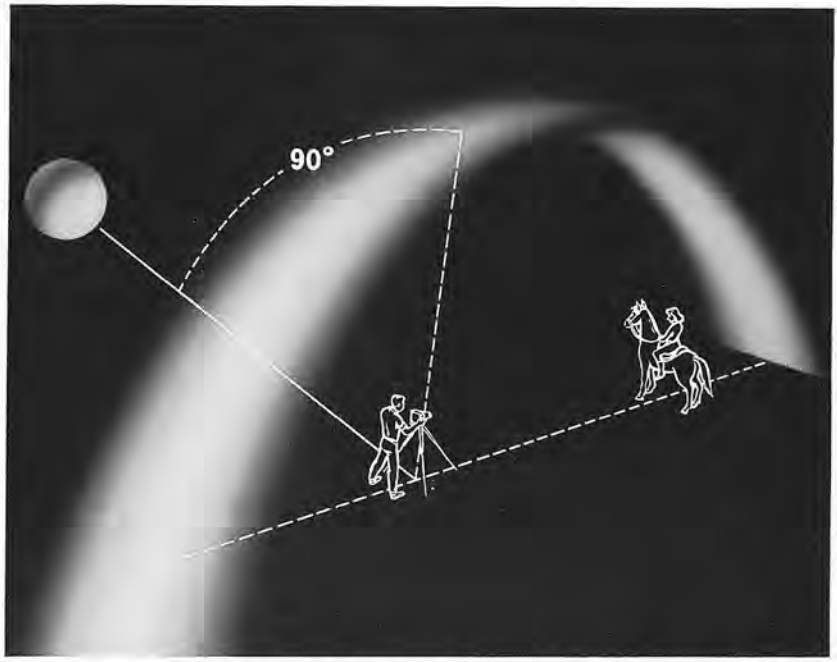
ALTHOUGH Type A and Type B color films are intended for use with tungsten illumination, and Type F films for exposure with clear flash bulbs, all three types of films can be used in daylight with the proper conversion filters. Three Kodak Daylight Filters are available:

	Type A Film	Type B and Type L Films	Kodacolor, Type F, and Type S Films
Kodak Wratten Filter No.	85	85B	85C

These three filters are somewhat similar in appearance, but since they are designed to modify daylight energy distribution to approximate three different light sources, they are not interchangeable.

If an artificial-light film is used in daylight without a filter, the results will be strongly blue to blue-green. The reason is that films balanced for tungsten or clear flash bulbs have relatively high sensitivity to blue light, which is relatively weak in artificial sources.

There is usually little visible difference between the results obtained on artificial-light films with the correction filter and the results obtained



Maximum darkening of the sky by a Kodak Pola-Screen over the camera lens takes place in a region at approximately right angles to a line extending from the sun to the camera.

on the Daylight Type films without a filter. However, if a difference does appear, better results are ordinarily obtained on the Daylight Type films. Blue skies may reproduce slightly greener in color on artificial-light than on Daylight Type materials. Also, there is usually a speed advantage in the use of Daylight Type films. A disadvantage of using artificial-light films with a conversion filter may become evident when an additional filter, such as a color-compensating filter, is required. Under these circumstances, the definition of the image may be impaired, or flare may result from interreflections on filter surfaces.

Although all of the Kodak Daylight Filters are classified as "relatively stable," it is unwise to depend on an old filter. Any filter should be tested photographically before it is used on an important job.

KODAK POLA-SCREENS

With color materials, the saturation in color of some reflecting surfaces can be increased with a Kodak Pola-Screen on the lens, and in a more limited application, the effects of a light-blue haze can be minimized. The Kodak Pola-Screen is approximately neutral in color throughout the visible region; thus no marked cast of color is imparted to pictures.

SCENIC PHOTOGRAPHY

In comparison to other types of outdoor color work, scenic photographs are probably the least difficult to make. Through the exercise of only ordinary care, quite pleasing results can be obtained. The success of such pictures, as in almost every other branch of photography, depends upon the photographer's ability to utilize all the existing factors to his advantage in order to produce the best results possible under the existing conditions.

LANDSCAPES

Reproductions of distant landscapes and mountain scenes may sometimes prove to be disappointing when details which were visible to the eye are not resolved in the photograph. This problem is not peculiar to color films. Atmospheric haze, the great distances sometimes involved, and the extreme fineness of detail—all contribute to the effect of lowered resolution. The impression of improved resolution, as well as a more natural feeling, can frequently be gained by including, in the very near foreground, objects in which detail can be sharply resolved. The trunk or limb of a tree, a stone wall, or a building is suitable; texture and shadow pattern in the foreground are often desirable. A further improvement is obtained in distant scenes when the lighting is contrasty rather than flat or uniform. Side lighting casts shadows beside each separate, fragmentary part of the scene, thus increasing the visual effect of contrast in the reproduction. Generally, the hours just before midmorning and just after midafternoon are the best times of day to make such pictures, and the shot should be made with the sun at an appropriate angle to the lens axis.

In certain types of pictures, the depth of color in the sky may be an important part of the story carried by the photograph. For example, in a promotional shot which is intended to suggest the ideal weather conditions of a particular locality, the color in the sky should be a clear, deep blue. Maximum color saturation is usually obtained in an area of the sky removed from the sun. That half of the sky in which the sun is located tends to range from a light blue color to a muddy, colorless appearance. The appropriate hour of the day or the angle of view should be selected to obtain the desired effect.

The selection of the time of day for making photographs in color can be exceedingly important, as shown in the illustrations on pages 28 and 29. Six completely different pictures, each creating a different mood

and feeling, have been made without changing the camera position. There are almost unlimited opportunities for applying to any outdoor scene this technique of making a series of photographs of the same scene under different atmospheric and lighting conditions. Perhaps the photographer must make a straightforward presentation with a fully lighted, midmorning scene or give the promise of a new day with the sun just hitting the mountain peaks. A sunset scene can be breath-taking, restful, or it can provide a sense of finality. The proper choice of the time and of the sky conditions enables the photographer to create, almost at will, these impressions.

Use of Kodak Pola-Screen for Landscapes

A Pola-Screen is a most useful tool in landscape photography. Under conditions of very light, blue haze over a great distance and at right angles to the sun, increased contrast and a marked improvement in the rendering of detail can result from its proper use. On a typically hazy day, the various planes in a distant scene tend to be indistinct and merge with each other. When a Pola-Screen is used, the distant blue haze is reduced and the separation of the various planes is improved. Under ideal conditions, the effects produced can be so marked that, in a side-by-side comparison, two photographs, one made with and one without a Pola-Screen, appear so dissimilar as almost to be mistaken for two separate scenes.

GARDEN AND FLOWER PHOTOGRAPHY

Gardens appear to the eye to be a mass of color which may, nevertheless, reproduce with rather disappointing results unless the photograph is carefully planned. Often there appear to be unlimited numbers of pictures in almost any direction, but closer examination of the image on the ground glass will usually serve to illustrate that careful planning is necessary before a satisfactory one can be obtained. The mass of color which the eye saw turns out to be some fairly light and some fairly saturated hues in relatively small areas, surrounded by very large regions of dark green or earth-brown colors arranged in a distracting pattern. When the final print is viewed, the dark and confusing background may dominate the picture, with small patches of bright colors showing here and there but no definite pattern or composition.

Attractive pictures of gardens can be made in which several flowers or a whole flower bed are shown. Generally, however, close-ups are more interesting, and more attractive results are possible. Often one blossom or only a part of the flower can be photographed against a plain background.

Lighting

The saturation of the colors in the flowers can be enhanced and improved if strong side or back lighting is used. Fill-in illumination can be provided, if necessary, by the judicious use of a diffuse reflector or by flash lamps. The shadows must be carefully lighted so that they are not blocked up in the reproduction, yet modeling and texture are retained. The procedure of supplying supplementary illumination to the shadows is, of course, applicable to relatively small areas. When the picture includes a whole flower bed or a corner of the garden, the use of such fill-in illumination is impractical. In such cases, side lighting or front lighting should be used.

The reproduction of pastel shades and delicately colored blossoms and petals can be strongly influenced by background colors, reflected light, and skylight. Casting sunlight into the shadows with a reflector will help to counteract any such effect from the surroundings.

Arrangement

A single blossom or stalk which is as nearly perfect as possible can be selected for a close-up. The resulting shallow depth of field throws the background completely out of focus. A plain background without specular highlights should be selected to avoid creating the unsharp, circular patterns frequently seen in photographs with out-of-focus backgrounds. Dark earth or a dark shadow will serve as a suitable background to set off a relatively light-colored flower. Pieces of colored cardboard having a matte surface can be used or show-card colors can be applied to white cardboard. Blue colors can be used to simulate sky, green for foliage, and brown to represent a background of earth. These cards should be placed at a sufficient distance so that not only are they out of focus but also no shadows are cast upon them by the flowers.

Blue sky almost always provides a suitable background for photographs of flowers. In some cases the stalks of the taller flowers can be pulled to one side to get them out against the clear sky. A low angle shot may be necessary or the flower can be picked or transplanted so that it can then be placed on a high platform. Small sticks or wands or a sharpened steel rod can be driven into the ground to support a blossom or to arrange the stalks in a more desirable fashion. The flowers can be held to these supports by the careful use of rubber bands. Several blossoms can be grouped in this way to form a pleasing composition. When long shots are necessary, the impression of massed colors can be gained by considerable transplanting or by moving potted plants into the area. This involves much additional labor but produces an effect which is more comparable to that which the eye sees.

Frequently, if an arbor or trellis can be used as the principal point of interest near the foreground, blossoms can be tied to it to give the impression of solid coloring. Sometimes a model can be employed to focus attention on one particular arrangement where several blossoms are closely grouped.

Camera and Lens Settings

The lens settings are determined by consideration of several factors: the amount of light available, the speed of the shutter required to stop any motion produced by the wind, and the depth of field necessary. When a picture is made of a long flower bed, considerable depth of field is necessary. With equipment such as the Kodak Master Camera, 8 x 10, the swings of the lens board and camera back permit much better placement of the envelope of field sharpness than is possible with a fixed-back camera. When it is necessary to prevent vertical lines in the subject from converging, even though the camera bed is tilted downward, the back of the camera should be kept vertical and the lens board tilted in such a way that the subject, lens, and film planes all intersect along a single line. Usually, however, convergence of verticals is no problem in photographing a garden, and better drawing of blossoms is obtained by leaving the back zeroed. In this case, also, the lens board should be tilted to fulfill the requirement stated above. If the flower bed is photographed in such a way that it extends across the film on a diagonal and into the background, the horizontal swings should be used in the same manner.

Since depth of field is sometimes a problem and, as a consequence, small apertures and slow shutter speeds are frequently necessary, the exposures can often be made more easily in the early morning hours, before any wind has risen, than at other times of the day. Too, the atmosphere may be clearer than later in the day. Immediately after a rainstorm the atmosphere tends to be clear, and the added advantage of having the loose dust washed off the flower petals and leaves improves the appearance of the colors in the photograph. For close-ups, drops of water can be put on the petals with a watering can to give the impression of recent rains. The ground underneath should be moistened, too, if it appears in the photograph, to make the story convincing. Moistening the blossoms and the ground helps to increase the contrast between the flowers and the background and improves the color saturation in the petals. If difficulty is experienced from the blossoms being set in motion by the wind, a shield of transparent plastic material, such as Kodapak Sheet, Clear, bent into a semicircle and held in position with supporting sticks, can be used as a windbreak. The photograph should

be made through the open side of the semicircle and not through the plastic material itself.

To soften and diffuse the sunlight, a layer or two of cheesecloth can be supported above the blossoms on three or four sticks. This prevents the highlights on pastel or white flowers from burning out and losing their surface texture.

SUNRISES AND SUNSETS

Pictures made at these times of the day can be the most strikingly beautiful of all types of outdoor photographs. The brightness range of a sunset or sunrise scene is many times greater than can be encompassed by the film. Maximum saturation in the reproduction of the colors in the sky requires that the exposure time be such as to favor the bright sky regions. For this reason, no attempt can be made to record detail in the shadow areas. Objects in the foreground, therefore, usually stand out as silhouettes against the colored sky.

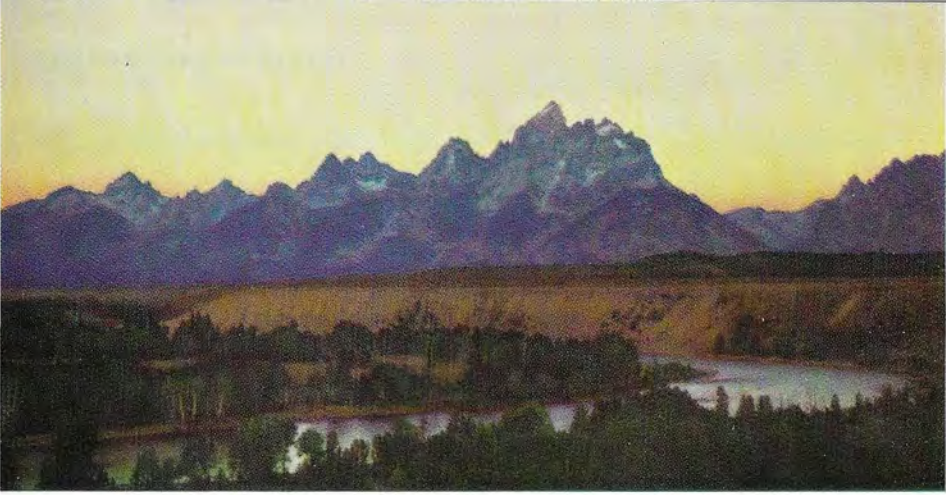
Actually, objects in the foreground often serve a very useful purpose. When the sun is unobscured at the horizon, the direct rays falling on the lens cause flare and ghost images. If a coated lens is used, these effects are minimized. It is frequently possible, however, to arrange the position of the camera in such a way that a foreground object casts a shadow directly on the lens. The scene should be examined carefully in the finder, or preferably on the ground glass, to make sure that no direct rays from the sun are reaching the lens.

Exposure Setting

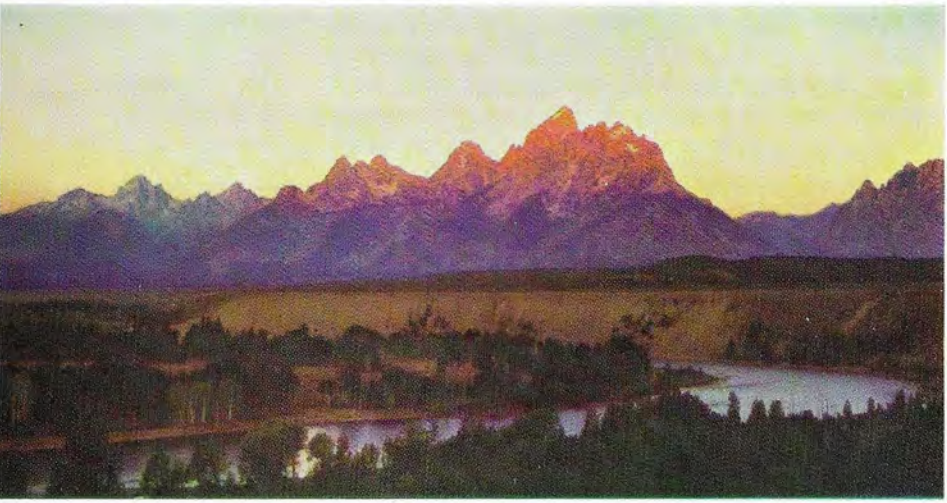
A photoelectric, reflection-type exposure meter is recommended as a means of exposure determination. The reading should be made by holding the meter up so that more sky than foreground is included within the acceptance angle. The exposure is then based on the highest reading. The meter should be shaded from the direct rays of the sun and pointed toward that part of the sky which is most representative of the whole sky area.

Arrangement of Photograph

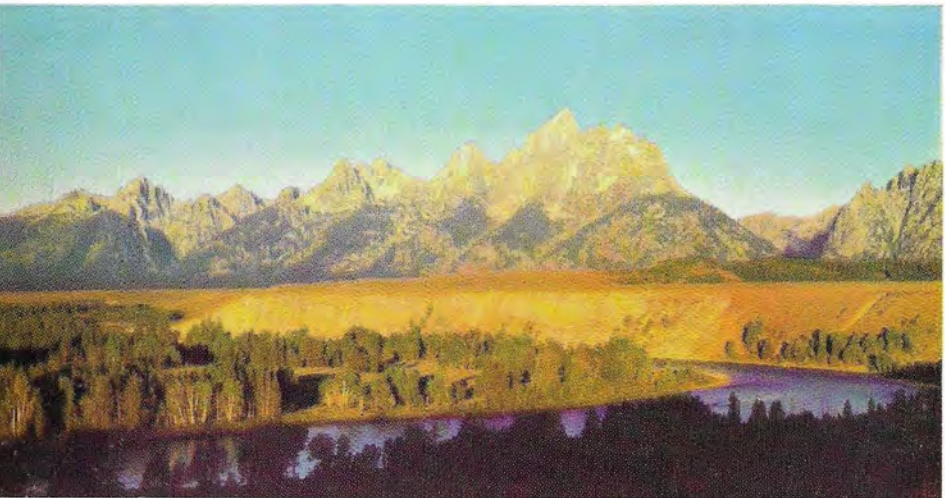
Sunset pictures taken over relatively flat terrain may contain a horizon line which separates the picture area into two distinct parts. If the color builds up toward the top of the picture, the division tends to disappear and the composition is improved. Objects such as trees, figures, buildings, or even a small hill in the foreground break the monotony of a low-lying line of colored clouds above the horizon.



Pictures made at various times of day show the effects of changes in the lighting direction and in the color quality of the light. (Above) Before dawn—scene illuminated only by blue skylight.

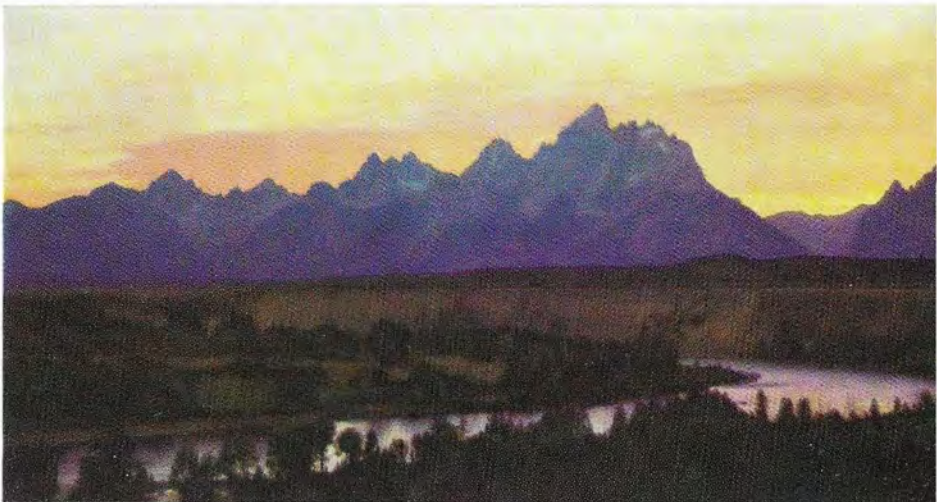


(Above) Reddish sunlight just hitting the peaks, foreground still illuminated by blue skylight. (Below) Early morning sunlight reaching the foreground—the color of the light is still very warm.



(Above) Strong side lighting—normal color balance and good color saturation in all parts of the scene. (Below) Back lighting has emphasized distant haze and lent an atmospheric quality.

(Below) After sunset. This is only one of several different pictures made late in the day. From Kodak Ektachrome transparencies taken at Grand Teton National Park by Ansel Adams.



ILLUSTRATIVE PHOTOGRAPHY

A COMMERCIAL or fashion photograph must portray the subject material to best advantage if it is to fulfill the purpose for which the photograph is made. An advertising photograph must attract and hold attention, and, in so doing, may create in the mind of the observer a desire for the product featured. As the photograph is planned and made, its specific purpose should always be kept in mind.

LIGHTING

LIGHTING conditions can improve or impair the effectiveness of a color photograph. As a rule, soft and diffuse lighting is flattering and therefore preferable in photographs of female models. Careful side or back lighting creates roundness and depth. Usually men can be photographed with more contrasty lighting.

Bright Sun Conditions

Photographs in which the properties and surroundings clearly indicate a bright sun should show the sharp shadow lines associated with such lighting. However, supplementary lighting is necessary to reproduce the visual appearance of the scene. The additional light must not destroy the impression of strong sunlight. Fashion shots of beach wear, for example, should create a mood of sunny warmth. They should be taken when the sky is not overcast, and the blue sky should be utilized for a background.

Lighting Direction. The hours during which the sun is directly overhead are generally unsuitable for making illustrative photographs, because shadows are cast vertically beneath a model's features, i.e., under the hairline on the forehead, and under the eyes, nose, and chin. Even if reflectors or other artificial fill-in sources are used, the vertical shadow lines are still undesirable.

The hours in the middle of the forenoon and the middle of the afternoon should be utilized for most illustrative shots. If no reflectors are used, the subject should usually be front-lighted. Moderate cross lighting can be used to lend modeling, but large, deep shadow areas should be avoided, and an exposure increase of as much as ½ stop may be necessary. If squinting proves to be a problem, it is sometimes helpful to have the subject look away from the light until just before the exposure is made. An exposure made quickly after the subject faces the light usually catches a natural expression.

Side and Back Lighting. These types of lighting have not been stressed in color work, particularly for the amateur. The problems of adding supplementary illumination make ordinary front lighting less difficult to handle. For making color pictures of professional quality, however, the photographer should usually avoid having the sun coming over his shoulder, as has so often been recommended for snapshots. The results of front lighting outdoors can be likened to those obtained indoors when a single flash reflector is mounted on the camera. Just as greatly improved modeling results when the reflector is held away from the camera, so side and back lighting add to the roundness and depth in the reproduction. The various planes are differentiated, and the light falling off into the shadows around the contours of the subject enhances the photographic result.

When the photograph is made with the camera facing into the sun, it is frequently difficult to prevent the sunlight from striking the lens directly, even if a deep lens hood is employed. It may be possible, however, to locate the subject in such a way that its shadow falls squarely on the lens. As an alternative procedure, the lighting angle can be changed enough so that the lens is adequately shielded from the sun by a tree trunk, building, or other near-by object. Coated lens surfaces reduce flare and ghost images to a minimum but do not eliminate them, particularly when the sunlight strikes the front element directly.

Adequate supplementary lighting must be provided to reduce the lighting contrast. The ratio between the amount of light falling directly on the subject and the amount reflected to the subject by the sky and surroundings can be checked either by exposure meter readings from a Kodak Neutral Test Card or directly by use of an incident-light meter. The shadow illumination is then provided by reflectors, blue flash bulbs, or electronic flash.

Diffuse Sunlight

Many types of fashion and illustrative shots require soft, diffuse, low-contrast lighting treatment which cannot be obtained in clear, bright sunshine without the use of elaborate supplementary lighting setups or diffusers. As has been noted earlier, ideal conditions for this type of photograph exist when a slight veil of haze is present over the sun. Large areas of white clouds also serve to soften the shadow lines and lighten the shadows. Because this type of illumination is so satisfactory for outdoor color work, it is frequently desirable, if time permits, to wait until such conditions are available. In a few localities an atmospheric haze often exists during the morning hours, and work can be planned for this time.

Other Daylight Conditions

Although color photographs are usually made under bright or hazy sunlight, it should be realized that such conditions are not the only ones under which color films can be exposed successfully. Under unfavorable lighting conditions, the photographer must rely on experience or intelligent experimentation to produce the desired results. There are times when a rainy-day effect is wanted, or a dull, lifeless impression must be created in the photograph. As an example, an advertisement for rain wear might show the product being modeled in the rain. The resulting bluishness of the light can generally be corrected to a satisfactory degree by using the Kodak Skylight Filter or, for additional warmth, one of the Kodak Light Balancing Filters of the Wratten No. 81 (yellowish) series.

METHODS FOR OBTAINING MAXIMUM DEPTH OF FIELD

WHEN it is impractical to obtain enough depth of field by stopping the lens down, the swing and tilt adjustments can be used with subjects that lie roughly in one plane. The focus will be sharp when the subject plane, the plane at right angles to the lens axis, and the film plane all intersect in a common line. However, best line relationships are obtained when the camera back is kept vertical and the lens board is tilted forward. Further information on this procedure is presented in the Kodak Data Book, *Camera Technique for Professional Photographers.*

Photomechanical Method

In certain types of illustrative photographs from which a photomechanical reproduction is to be made, an intermediate step in the reproduction process can be used to increase the effective depth of field in the picture. Such pictures should have distinct, separate planes into which the background and foreground fall. As an example, a girl can be placed in the foreground, and a group of people in the background at some distance away from the girl. Considerable depth of field is needed if both parts of the scene are to be sharp in the reproduction. Two transparencies are made without changing the camera position; the first with the camera focused on the foreground, the second with the camera focused on the background. A photoengraver or photolithographer can combine the sharp areas of both transparencies so that both are sharp in the final reproduction. The division should, if possible, be made around a natural boundary line rather than around the foreground figure. This procedure avoids an artificial appearance around the foreground caused by any necessary handwork in case the image sizes are not identical.

EFFECTS OF COLORED SURROUNDINGS

NEAR-BY colored surroundings can produce a cast of the same hue on the flesh tones or other near-neutrals. Although it is rather infrequent that colored reflections encountered in actual practice are troublesome, the possibility of such an occurrence should be kept in mind. Before the film is exposed, a careful visual appraisal of the scene must be made in order to disclose this condition, which would otherwise become obvious only in the final photograph. A color-compensating filter is of no help in this case. Any filter selected to correct the color balance in one part of the scene would impart an undesirable hue to the other part. A change in the position of the subject with respect to the direction of the sunlight generally eliminates the offending reflections. For example, if a shot is being made of a girl lying on the grass with her head propped up in her hands, the grass may cast a greenish hue on the underside of her arms. Her location with respect to the direct sunlight should be changed so that the light is not reflected from the grass onto the arms in a region seen by the camera. A reflector or flash lamp can be used to add illumination in the shadows to further reduce the effects of the greenish reflections. Often the colored surface can be shaded from the sun, particularly if it is outside of the picture area.

COMPOSITE LIGHTING EFFECTS

EFFECTIVE outdoor color photographs can be made of subjects against a late afternoon or early evening sky background or a pattern of street or house lights. This type of picture may require a late afternoon exposure to lighten the sky and then, without movement of the camera, an exposure in the evening to record the background and the lights. The subject material can be illuminated by flash- or floodlighting during the second exposure. The combination of the first exposure and the fill-in during the second exposure must be enough to give the proper rendering of the principal subject. Artificial-light films can be used with the daylight correction filter for the first exposure; the filter should then be removed and 3200 K floodlights or clear flash lamps with the appropriate filter used as supplementary lighting for the second exposure. If models are included in the scene, it may be necessary to give only the one exposure in the early evening when the sky is still light from the sun but the street lights have been turned on. The supplementary lighting should be directed on the subject or models in such a way that the foreground is not illuminated; otherwise an unreal effect may be produced. Different effects can be obtained by varying the relative exposures, and, therefore, no specific recommendations can be given.

UNDERWATER PHOTOGRAPHY

UNDERWATER photographs can be made from a vessel, with submerged windows, that will accommodate the photographer and camera, through a glass wall or window of an aquarium or tank, or with the camera under water. In the latter case, the camera must be protected in a watertight case with a plastic or glass window. A variety of housings are available and range from simple rubber or plastic bags with a transparent faceplate to complex cast-metal housings.

UNDERWATER EXPOSURE

EXPOSURE conditions under water depend on many factors, including weather conditions, the angle of the sun, the clarity of the water, the distance of the subject below the surface, and the color at the bottom. A light meter which reads reflected light is almost essential. The meter should be sealed in a watertight, glass jar and taken under for a reading. However, even with exposure readings from a light meter, experimentation is often necessary to determine the best exposure to produce the desired results.

Color photography under water is further complicated by the water's selectively absorbing and scattering the different colors of light. Color absorption and scattering vary for different localities and for various water conditions, but, generally, the red and, to a lesser extent, the blue wavelengths tend to be absorbed, so that the light which penetrates to any distance below the surface is decidedly greenish. A filter, such as the Kodak Color Compensating Filter CC30M or CC30R, can be used to reduce the strong green cast. The filter, of course, reduces the effective film speed significantly and should not be so strong that it destroys the underwater atmosphere.

The color of the water varies from one location to another, and, even in one location, it can change rapidly as a result of floating particles of rock or soil and the kind and amount of floating plants and animals. The over-all tint imparted by the color of the water can be offset to some extent by the use of color-compensating filters, such as the red or magenta filters mentioned in the case of greenish water. It is difficult to make colors reproduce as they would if the subject were above water, but such an effect usually is not desired anyway.

The light which does penetrate is strongly scattered except in very clear water. This light scattering produces a colored haze or cloudiness between the camera and the subject. In order to reduce the effects of

the intervening haze, it is usually desirable to work as close to the subject as is practical. Color saturation decreases and the colors of the subject change as the distance from either the light source or the camera to the subject increases.

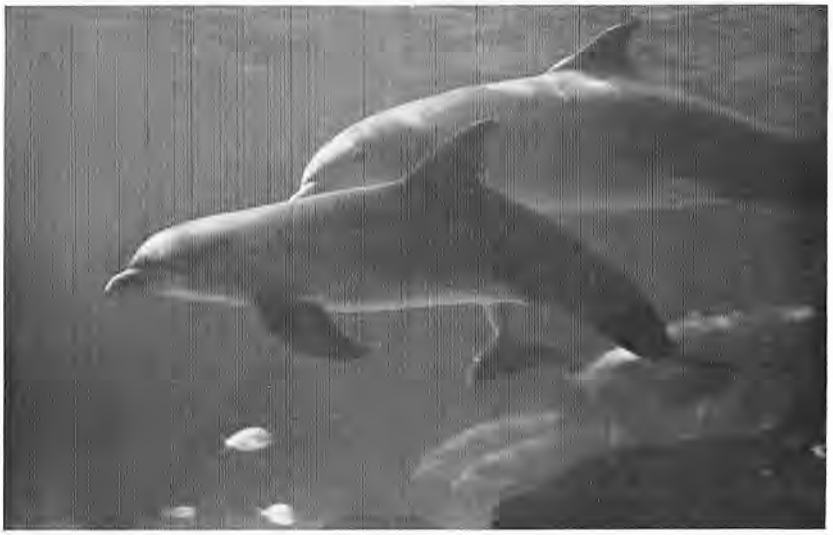
FLASH

USING underwater flash is helpful, not only because it will, more or less independent of the depth, supply dependable illumination, but also because it will reduce the effect of the colored, scattered haze produced by natural lighting. Exposure settings for flash will depend on the details of the particular equipment used and must be determined by practical experiments.

LENS

UNDER water, refraction of light rays magnifies the subject slightly, so that objects appear closer than their actual distance. To cover the same field, it is necessary to place the camera at a greater distance from an underwater subject than from the same subject above water. Therefore, a short-focal-length lens is desirable, because it permits framing larger subjects without increasing the camera-to-subject distance so much that water distortion and haze become serious.

When a lens is focused on an underwater subject, the apparent, rather than the actual, distance should be used. Rangefinders indicate this apparent distance.



ARCHITECTURAL PHOTOGRAPHY

A LEADING contemporary architect has said that the elements of architecture are light and shade, walls and space. These elements are paramount in the photographic interpretation of buildings.

LIGHTING FOR ARCHITECTURE

SINCE sunlight and skylight generally furnish all the illumination on architectural subjects, sun angles and shadow areas should be studied carefully so that the camera captures an expressive play of light and shade. Form in architecture is often washed out by uniform lighting. Side lighting separates planes, reveals texture, shows shadow patterns.

SINGLE PHOTOGRAPH VERSUS PICTURE SERIES

THE relationship of walls and space in architecture is revealed not so often by over-all pictures of buildings as by picture compositions involving a segment of the structure. A series of such pictures usually tells more about the building than a single, over-all shot. Architectural photographs which include too much of the subject material often lack the strong, simple composition and center of interest obtainable in a single part of the building. Over-all photographs are necessary, of course, to relate a building to its surroundings.

FIGURES AND CLOSE-UPS

USING figures in architectural photographs gives buildings relative dimensions. To have value in showing the size of a structure, the figures should be located in the same plane as that of some important part of the structure. Since figures used for disclosing scale are generally positioned where they are subordinate to the building, they rarely become important compositional elements in the picture.

Close-up photographs are valuable in any photographic study of a building and can show either interesting, ornamental details or basic design units. Photographs of architectural details reveal the character of a building—a character displayed by such ingredients as decorative features, brick or stone patterns, texture, etc.

CAMERAS AND LENSES

IN no other branch of outdoor photography are a versatile camera and a lens of adequate covering power more necessary than in architectural work. The back swings on a view camera are needed to give the proper

parallelism to the straight lines in the photograph. The camera back should be vertical unless convergence of the vertical lines is desired.

Other cameras, including 35mm, can be used for architectural photography if their limitations are understood. Reflex cameras are best because they permit more careful composition than viewfinder models. The camera must be held level to reduce vertical distortion. Holding the camera level often means that the photographer has to move back from his subject and include a large foreground. Wide-angle lenses cause more objectionable distortions than normal or telephoto lenses.

The convergence of parallel lines in color negatives can be corrected during the enlarging operation by tilting the enlarger easel. The negative carrier must be tilted, also, so that all of the image is in sharp focus.

SUN PORCHES AND TERRACES

PHOTOGRAPHS of porch and lawn furniture, draperies, and models must often be made in typical home surroundings, perhaps on a sun porch or terrace, in an open patio, or by a large picture window. If the models are placed in the foreground, with a sunlit scene behind them, supplementary illumination of proper quality and intensity should be provided.

When daylight is contributing more than approximately 25 percent of the general illumination in the area, or when windows through which the outdoor scene is visible are included in the photograph, Daylight Type color films should be used for best results. Amounts of daylight in excess of 25 percent will tend to produce a bluish cast on neutral areas and give rather poor rendering of flesh tones when Type B or Type A films are used. The proper rendering of colored materials, such as fabrics, is usually important, and large amounts of daylight necessitate the use of films balanced for that illumination.

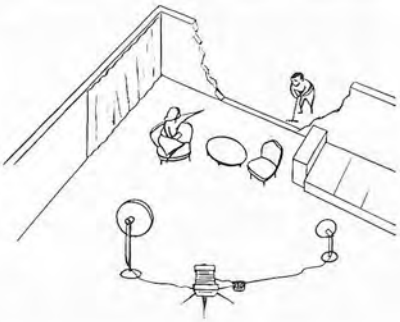
Blue flash bulbs or electronic flash can be used to provide the illumination for that part of the scene not directly illuminated by sunlight. The additional illumination must equal the outside daylight illumination if part of the outdoor scene is included in the photograph.

METERED-FLASH EXPOSURE DETERMINATION

WHEN several flash bulbs are used, determine the exposure thus:

Place No. 1 photoflood lamps in the reflectors. Take a meter reading of the scene under the combined illumination of daylight and artificial light. Find the approximate lens opening on the calculator dial opposite either the 1- or 2-second mark. For No. 22B or 2B bulbs, use the 1-second mark; for No. 50B or 3B, use the 2-second mark. Determine the actual shutter speed to be used at the selected lens opening from a meter reading of the exterior scene alone.

Lone figure in photograph above of Frank Lloyd Wright's Beth Sholom Synagogue in Philadelphia gives the building relative dimensions. Without the figure, the size of this unusual structure would be difficult to discern, and the impact of the building would be lessened. Detail at right shows the glass dome of the synagogue, which Wright has called "a mountain of light." Robert P. Fordyce, Eastman Kodak Company, took the photos on Kodacolor Film 135. Negatives were printed on Panalure Paper.



The lighting arrangement for the picture opposite was worked out with photoflood lamps. Six No. 50B flash lamps were then substituted in the large reflector shown at the left in the diagram, one No. 50B lamp in the reflector at the right. Hedrich-Blessing photograph for Better Homes and Gardens Magazine.

PHOTOGRAPHING STORE WINDOWS

COLOR photographs of displays in store windows can open up a good commercial field for the photographer. Window decorators and arrangers of advertising displays may need a photographic record of the results of their creative work for publication in magazines or to show to manufacturers of the featured products. The store itself may wish to keep on file an accurate record of such displays. Color transparencies or color prints provide a much better means of subsequently identifying the various articles than do black-and-white prints. Sheet film is often the best choice if color prints are needed for the file or for reproduction purposes; roll film either in a miniature size or in the 620 or the 120 size is convenient for filing slides.

Store-window displays are usually best photographed during the dark hours of early morning. Minimum interference is experienced then from passers-by and from automobile headlights. To avoid imaging the camera or photographer in the window glass, the shots are usually made at an oblique angle to the plane of the window. If reflections from street lights or lights from other store windows prove troublesome, a Kodak Pola-Screen placed over the lens will eliminate many of them.

The color quality of the lighting units in the windows is seldom satisfactory for use with Type B films without filtering. The lighting also tends to be contrasty, coming as it does from the top or bottom of the window. Clear flash bulbs are normally used close to the camera to lighten the heavy shadows. Each picture can be given two separate exposures, one by the existing illumination in the window, the other by the illumination from the flash bulb. By making two separate exposures, it is possible to use a different filter for each in order to allow for the fact that neither light source is the one for which the film is balanced. The filter required for the window illumination is usually one of the bluish Kodak Light Balancing Filters, perhaps a No. 82C. For clear flash bulbs, the normal recommendation (No. 81 series) can be used.

It is exceedingly difficult to judge the relative amounts of exposure required for the flash and window lights. Usually a meter reading from outside the window of the display will be of little use. At low levels, the accuracy of the reflected-light meter reading is likely to be questionable, and the deep shadow regions may cause erroneous indications. Experience and the tabulation of data on previous tests must be relied upon to give correct exposures. When the correct exposure setting is in doubt, a series of settings should be used for several separate trials.

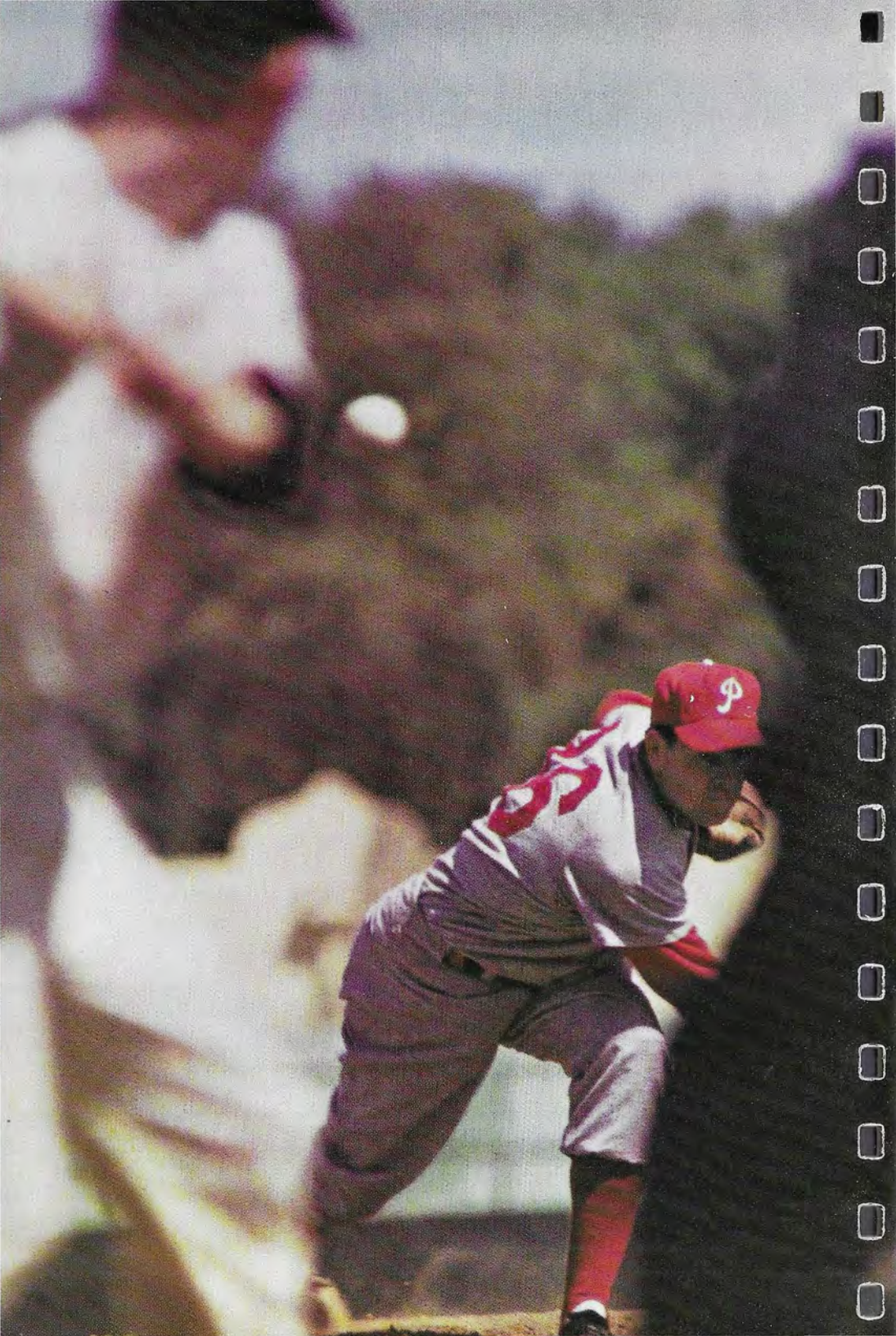
NIGHT PHOTOGRAPHY

In night photography, numerous effects can be produced by variations in the exposure time. Since the light sources themselves are frequently included in the picture, the range between highlight and shadow areas is so extreme that it is possible for the film to record only part of it. It is difficult to predict with certainty the results which will be obtained at any particular exposure level, and, therefore, it is sometimes necessary to make a series of exposures, each two differing by a whole stop. Experience and the use of an exposure meter will serve to determine the starting point of the exposure series. Important highlight areas should show detail and retain good color saturation. Overexposure will, of course, produce more detail in the shadows, but, at the same time, the lighter-colored areas will tend to lack saturation.

A rainy night often provides the best conditions for this type of photography. The reflections of colored signs from wet pavement may prove to be more interesting than the signs themselves. The mistiness in the atmosphere gives a soft quality to the light. A pleasing effect can be created by including a near-by street lamp in the picture. The camera should be located so that the lens is shaded from the direct rays of the lamp. A ring of light is sometimes created around the lamp because of the mist in the atmosphere. Figures in the foreground, silhouetted against the light, help to create an illusion of depth.

Exposure

The low levels of illumination encountered in photography at night necessitate relatively long exposure times. These restrict the subject material to either inanimate objects or persons so posed in the picture area that they can remain motionless for the length of time the shutter is open. If a meter is used, the reading should be determined in accordance with the manufacturer's instructions for dim-light operation. The illumination level in different scenes varies over wide limits, and it is therefore difficult to give specific exposure recommendations. The times may range from 1 to 5 seconds at large apertures for floodlighted buildings, store windows, brightly lighted streets, and theater marquees. Animated electric signs may require less exposure, whereas street scenes in which only a few street lamps provide illumination may require exposure times of several minutes. Exposure meters may give no reading at such low levels of illumination, and a series of exposures at times differing by a factor of 2 or 4 should be tried.



AERIAL PHOTOGRAPHY

A CAMERA used for aerial work should be locked rigidly at infinity focus, and any filter or lens hood should be attached firmly. If the camera is of a bellows type and must be exposed to the slip stream, a protecting flange or cone should be attached to the camera body to prevent the collapse of the bellows. In order to avoid obtaining unsharp photographs as a result of vibration, neither the camera nor any part of the body above the waist should be in contact with the plane.

REDUCING HAZE

IT is important to wait for the clearest possible weather. The problem of haze in making photographs from the air is somewhat the same as in photography of distant landscapes. In general, the bluishness of the ground from the air, even on a relatively clear day, is greater than that obtained in landscape shots. It increases with an increase in altitude and is more apparent in oblique than in vertical pictures. The effect of haze at any given altitude also depends on the direction in which photographs are made, increasing as the camera is turned toward the sun. The effect is minimized when the sun is behind the camera.

Experience has shown that for aerial photographs made on days when even a slight amount of haze is present, and from all but the lowest altitudes, an improvement in the color rendering for the Daylight Type films is obtained by the use of a Kodak Skylight Filter over the lens. Artificial-light films with the appropriate daylight conversion filter but without the Skylight Filter also produce about the same results as Daylight Type films with the Skylight Filter. However, Daylight Type color films usually give a more satisfactory reproduction of blue sky and for this reason should be used with the Skylight Filter if much important sky area is included in the photographs.

CONTRAST

SIDE lighting is usually preferable to flat lighting in an aerial photograph, unless haze is a problem. Shadows cast by objects which are side lighted increase the apparent contrast in the photograph and make the objects stand out from their surroundings. The actual recording of

Mark Kauffman made this unique and dramatic photograph of baseball pitcher Robin Roberts for *Sports Illustrated*. The photograph later became one of 99 outstanding prints selected for the production, "Sports in the United States," which toured 5 continents and 67 countries. Sports speak a fond language native to every country, and photography communicates that language with no need of translation. This remarkable photographic show helped people everywhere better understand the character of Americans.

detail in the shadows is unimportant, except in low-altitude photography, because the shadow areas are usually extremely small and occupy a very small fraction of the total picture area. Back-lighted pictures tend to have an over-all bluish veil caused by the scattering of light by any smoke or dust particles present. Therefore, back lighting should, in general, be avoided.

Color-negative and reversal films will render greater contrast for aerial pictures if the development time (first developer for reversal films) is increased. However, such increased development increases graininess and may change the color balance. With reversal films, increased development also lowers the maximum density. Therefore, practical tests should be made to determine the development time for the effect desired.

EXPOSURE

Subjects for aerial photography differ from ground, or terrestrial, subjects in several important respects. In the first place, the average reflectance of a typical aerial subject is usually less than that of a typical ground subject. Dark objects, such as foliage, roof tops, earth, and fields, make up a large proportion of the total area in an aerial view. Highlight portions of the photograph occupy a much smaller and less important space than in ground shots. Shadow areas often tend to become small and relatively unimportant.

Brightness Scale. Another important difference between aerial and ground photographs is the compression of the brightness scale of the aerial scene; this compression increases with altitude. Lens flare, haze, and lack of resolution of fine detail, particularly at high altitudes, appear to be the contributing causes.

The brightness scale of the scene itself is always greater than that of the image of the scene in the camera. The average brightness ratio for an aerial photograph made at a very low altitude is around 160:1. In the camera, this brightness ratio is compressed to approximately 100:1 or less. On an average sunny day with a noticeable amount of haze, the average brightness ratio in the camera becomes about 30:1 at 2000 feet, 15:1 at 6000 feet, and 8:1 at 10,000 feet. Above 10,000 feet, little change in the brightness ratio takes place.

The photographic effects produced by these differences in aerial subjects are at least two in number. Generally, the over-all impression gained from viewing an aerial photograph made on a reversal color material is that it appears dark and, therefore, underexposed. When the transparency is examined carefully, however, it will usually be seen that there is adequate detail rendering in the shadow regions and that

the transparency appears dark because the subject material actually is dark. If the exposure is increased to obtain a lighter transparency, the detail in whatever highlights there are may begin to lose gradation.

The second photographic effect results from the compression of the brightness scale of the scene being photographed. Color materials are able to handle the brightness ratio of 100:1 encountered in the camera image of a scene at low altitudes. Brightness ratios of 30:1 at 2000 feet and 15:1 at 6000 feet, and even lower values for greater altitudes, permit the exposure level to be varied over much wider limits than is normally possible.This increased exposure latitude is most noticeable when an exposure series of the same or similar subjects is run over a range of two or three lens stops. It becomes difficult to select the transparency which has the "right" exposure. Actually, because individual aerial subjects are not necessarily average or typical and may fall on one end or the other of the reproduction curve of the film, it is always preferable to determine the exposure as carefully as possible, even though this latitude does exist. The recommended exposure for aerial photographs made under clear atmospheric conditions and at low altitudes is the same as that for average terrestrial subjects. The lens opening should be decreased with increasing altitudes. Between 1000 and 2000 feet, the lens opening should be approximately ⅓ stop smaller than for ground subjects; between 2000 and 4000 feet, ½ stop smaller; and above 4000 feet, 1 stop smaller—this is about the limit.

Selection of Shutter Speed. The shutter speeds should be as short as possible, consistent with the limitations of the lens. The speed requirements are based on the altitude at which the pictures are being made, the roughness of the air, the ground speed, and the angle made between the camera axis and the vertical. Morning hours usually afford the smoothest flying in many regions, especially during the summer months, although ground haze is usually more prevalent during the early part of the day. For verticals and low obliques, for example, a shutter speed of 1/50 second or shorter must be used at altitudes no lower than 2500 feet when the ground speed is no more than 75 miles per hour. If the plane is flying at a lower altitude or the ground speed is greater, a shutter speed of 1/100 second must be used. If the ground speed is 200 miles per hour, 1/200 second must be used at an altitude of 2500 feet. If it is necessary to use longer shutter speeds than those recommended, the ground motion can be minimized by following a particular spot on the ground with the camera or by shooting when the plane is banked in a turn so that the change in view is primarily angular. If pictures are made as the plane is approaching or drawing away from the area to be photographed, the image changes only in size.

PHOTOGRAPHING ACTION

PHOTOGRAPHING sports activities, animals in action, and other moving subjects requires fast shutter speeds and proportionately larger lens openings. The shutter speed required depends on the speed of the action, its direction with reference to the camera, and its distance from the camera. Motion parallel to the film plane requires a faster shutter speed than motion toward or away from the camera or motion which is diagonal to the camera film plane. Distant action can be stopped by slower shutter speeds than action occurring close to the camera.

Since photography of many sports events and animal activities must occur at some distance from the subject, a long focal-length lens becomes desirable. Long focal-length lenses increase the image motion on the film in direct proportion to the focal length of the lens. For example, if 1/100 second is satisfactory to stop motion with a 50mm lens, the same action at the same distance will require a shutter speed of 1/200 second with a 100mm lens.

Because of the fast shutter speeds used in action photography, larger lens openings are necessary, and, therefore, the depth of field becomes shallow and the focusing, critical. In some types of action photography, it may be necessary to estimate the range in which the action will take place and to focus on a compromise distance in the middle.

PANNING ACTION

PICTURES taken at high shutter speeds sometimes freeze action so effectively that the result is static and lifeless. Some blur in the action, therefore, may be desirable. To give the impression of great speed, the scene can be panned by pointing the camera at the action and swinging the camera along with the subject as the exposure is made. When this technique is mastered, the results will show the moving subject stopped and the background blurred. Panning is also useful when, because of lighting conditions, a fast shutter speed cannot be used.

INCREASED FILM SPEED

IF it is necessary, the exposure index of some color films can be increased by using special processing. Although the photographic quality and color balance obtained by modified processing are generally satisfactory, it is recommended that the normal exposure index and normal processing procedure be used except under emergency conditions, and then, first make a test on film of the same emulsion number.

EXPOSURE

THE somewhat limited exposure latitude of all color films as compared to most black-and-white materials is well known. Since Kodak Ektacolor Films and Kodacolor Film are printed by negative-positive procedures, these materials have somewhat more latitude than reversal materials, such as Kodachrome and Kodak Ektachrome Films, particularly on the overexposure side. However, for best quality in the final reproduction, the exposure for all types of color materials should be determined accurately and with past experience in mind. When a positive transparency is to be used for reproduction purposes, by either photographic or photomechanical means, and the lighting ratio is held within the recommended limits, an improvement in highlight detail will be gained if the exposure is less than normal by about ⅓ stop.

USE OF EXPOSURE TABLES

COMPLETE daylight exposure tables are given in the Data Sheets in the Data Book, *Kodak Color Films*. Under the typical sky and lighting conditions described in these tables, properly exposed color films can be obtained if the exposure recommendations are followed carefully.

Side- and Back-Lighted Subjects

On clear, bright days, side- and back-lighted subjects require more exposure than normal front-lighted subjects if no supplementary lighting is provided to lighten the shadows. The amount of the increase depends upon the importance and size of the shadow regions and upon the relative importance of the subject material in the foreground. For example, if figures are located in a landscape shot at a distance of approximately 25 feet, the exposure selected should give good, over-all color rendering without necessarily favoring the reproduction of the figures. On the other hand, if the figures are included to advertise a fishing rod in use, for example, satisfactory reproduction of the figures themselves is important. The exposure setting should then be based on the light falling on the figures, even though the distance is great.

Generally, however, at distances beyond 25 or 35 feet, the objects or figures are sufficiently unimportant because of their size as to require no special exposure-setting consideration. In side-lighted close-up shots, the exposure setting should be increased by about ½ stop over that for normal front-lighted subjects. Back-lighted close-ups require at least a full-stop increase, and sometimes more may be necessary.

Distant, back-lighted shots with no important shadow regions usually require no exposure setting increase. Other factors do influence the exposure setting required. These factors include the condition of the sky (clouds or haze adds light to the shadows; a clear atmosphere produces extreme lighting contrast), and the presence of open-sky area on the shaded side of the subject or of such surroundings as dirt roads, foliage, or buildings. Previous experience under similar conditions should be used as a guide, or a series of exposures should be made differing by ½-stop intervals from the calculated exposure settings for color-reversal films and 1-stop intervals for color-negative films.

Hazy-Day Lighting

When the lighting is soft and diffuse, the normal hazy-day exposure for front-lighted subjects is satisfactory for side- and back-lighted subjects as well. The lighting ratio is sufficiently low so that proper detail is preserved in the shadows, regardless of the lighting direction.

Subject Types

Outdoor subjects are generally classified as belonging to one of three general types: average, dark, or light. For subjects having other than average reflectance, the typical exposure settings are usually altered. Dark subjects consist of close-ups of models with dark complexions and wearing dark clothes, large areas of heavy green foliage, dark-colored buildings, dark flowers, brown or black animals, and other subjects of comparatively low reflectance. Examples of subjects in which light tones predominate are models with fair complexions and wearing light-colored clothes, light-colored flowers, white buildings, and scenes in which the sparkle and texture of light-colored objects must be retained. Give dark subjects ½ stop more exposure than average subjects, and light subjects ½ stop less. Scenes on light sand or snow, or long shots of people in such surroundings, require a full stop less than average subjects. For such atypical subjects, the same exposure adjustments apply to both color-reversal and color-negative films.

At times compromises in the exposure settings must be made. A model with a light complexion but wearing dark clothes might be classified as an average subject, particularly if good color reproduction of both costume and flesh tones is desired. Close-ups of models in beach or snow scenes are usually classified as average subjects; distant shots of the same models are usually classified as very light subjects. The classification of the subject as dark, average, or light should be based principally upon the reflectance of the main point of interest in the scene to be photographed.

EFFECT OF FILTERS AND BELLOWS EXTENSION

WHEN a Kodak Color Compensating or Light Balancing Filter or a Kodak Pola-Screen is used over the camera lens, an exposure increase is usually required. The amounts of the increases for filters are given in the filter tables in the Data Book, *Kodak Color Films*. The increase in exposure required for the Pola-Screen is discussed in the instructions packed with the device. These increases must be applied in addition to any other required by the nature of the subject or the lighting.

Although extreme close-ups are encountered less frequently outdoors than in the studio, whenever subjects are located nearer to the camera than 8 times the focal length of the lens being used, an exposure increase over that otherwise required is necessary. For example, in photographing flowers, the camera image may be as large as the flower itself, and the exposure setting must be increased by two stops or 4 times its normal value. A handy method of determining bellows factors for both view cameras and 35mm cameras is presented in either the *Kodak Color Dataguide* or the *Kodak Master Photoguide*. These publications are sold by Kodak dealers.

USE OF PHOTOELECTRIC EXPOSURE METERS

A RELIABLE photoelectric exposure meter can be used to advantage for out-of-door color photography, particularly when the lighting conditions are too unusual to evaluate by other means. The meter should be regarded not as an absolute necessity, but as a very useful accessory. Under standard outdoor conditions with average subjects before the camera, satisfactorily exposed color pictures can be obtained by following the exposure recommendations in the Data Book, *Kodak Color Films*, or in the instructions packed with the film. Photographers who do not use the techniques explained in the manufacturer's instruction manual often obtain less satisfactory results through the use of the meter than they would obtain by following tables of exposure recommendations. On the other hand, when the lighting conditions are unusual, a meter, if correctly used and interpreted in terms of experience, can result in a saving several times greater than the original cost of the meter.

The Exposure Indexes published in the instruction sheets packed with the film and in the Data Book, *Kodak Color Films*, should serve as a guide or starting point for exposure tests. These values are recommended as settings for meters marked as requiring American Standard Exposure Indexes. Adherence to the manufacturer's instructions for specific meters is strongly recommended. Some of the general considerations involved in the use of all types of meters and precautions to be observed are discussed in the following section.

Operation of Exposure Meters

When a meter is pointed at a large, uniform area, such as a light stucco wall, two factors affect the amount of light falling on the meter cell: first, the amount of light falling on the wall, and second, the ability of the wall to reflect that light. The more light falling on the wall, the higher the meter reading. The whiter the surface of the wall, the higher the reading. The amount of light falling on the wall is called "illumination" or "incident light." The ability of the wall to reflect light is called its "reflectance." A dark gray wall in bright sunlight might give the same reading as a white wall on a cloudy day. The thing that is the same in these two cases is the brightness of the wall. Brightness, then, is a combination of illumination and reflectance. An object, such as a black automobile, can have higher brightness in sunlight than a model's white dress in deep shade. Even though the black automobile may reflect only 10 percent of the light, the illumination of direct sunlight is so great that 10 percent of it is more than perhaps 85 percent of the dim light falling on the white dress in deep shade.

It is possible to measure either the amount of light falling upon a subject or the brightness of the subject itself. The "incident-light" meter measures the amount of light falling on the subject. It is held at the subject, and the sensitive cell of the meter faces the camera or the light source. To measure the brightness of a subject, a "reflected-light" reading is made. In this case, the meter is aimed at the subject, and the light from the sun does not strike the meter until it has first been reflected from the subject. Several of the newer meters can be used with the proper attachment to measure either incident or reflected light.

Unlike the stucco wall in the example above, most subjects are not of uniform brightness. The usual scene runs in brightness from dark objects in shadow to flesh tones or even a white surface in sunlight. A reflected-light meter adds up the brightness of all these areas, and the measurement is therefore called an "integrated-brightness measurement." Bright or large highlight areas affect such measurements unduly.

Precautions in the Reflected-Light Method

Reflected-light measurements can be affected by a background differing widely in brightness from the subject, or by very bright or large highlight areas. Readings made from the camera position will differ considerably for a person standing first in front of a white wall, and then in front of a shadowed entrance. Too much influence from the background can be avoided by close-up readings.

Bright highlight areas can lead to underexposure. The sky is most frequently in this role, especially since a meter is required more fre-

quently in the absence of strong sunlight. An overcast sky, or in fact any sunless sky, is many times as bright as the landscape beneath it. Therefore, in the absence of sunlight, the meter should be tilted downward to avoid sky effects. A pure blue sky, with no bright clouds near the field of view, has about the same brightness as the landscape, and therefore need not be excluded from the meter. Other broad highlight areas, such as near-by concrete sidewalks, and even white shirts closer than 10 feet, can influence the meter unduly. The same is true of sunlight reflected from water or near-by polished metal.

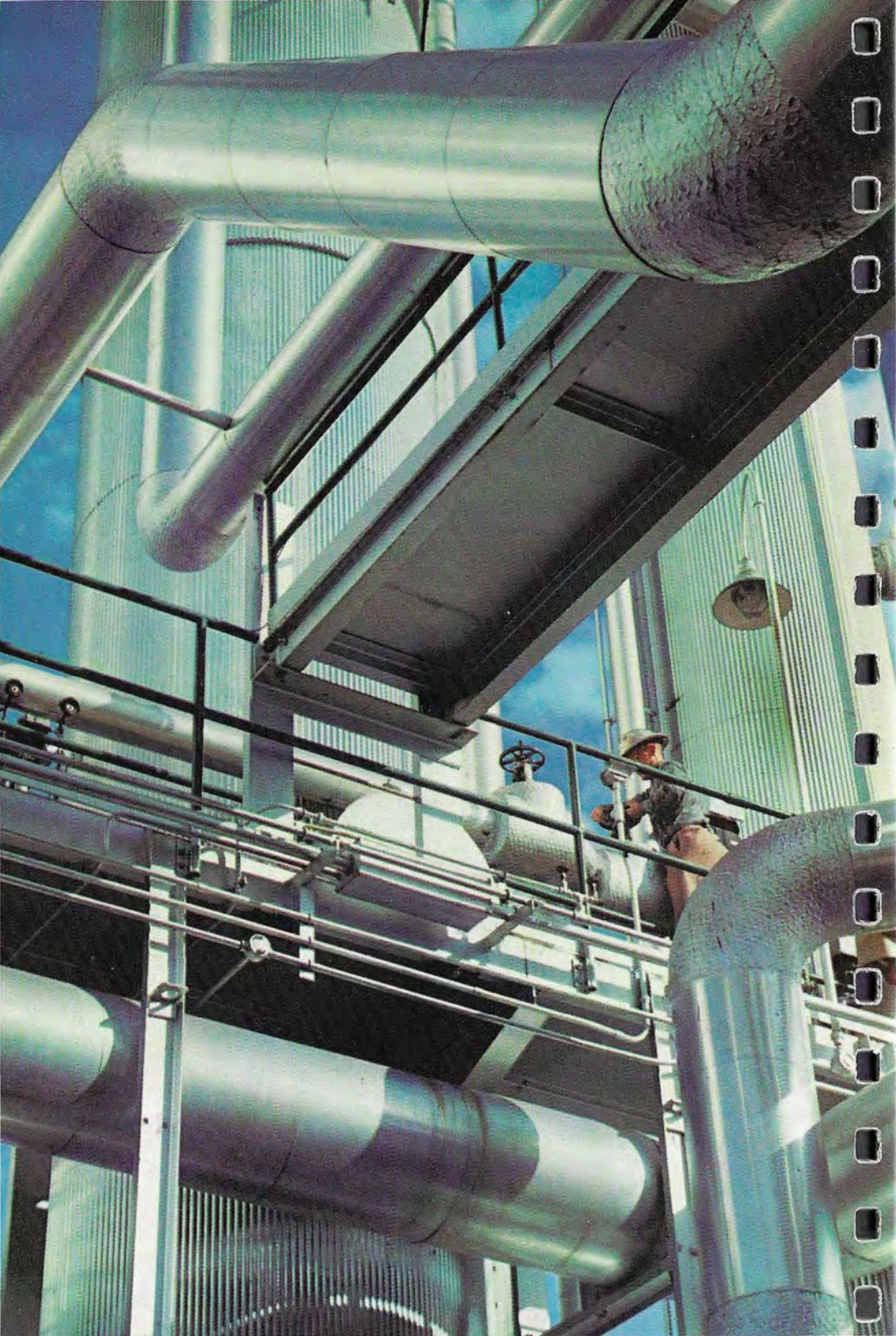
Subjects of almost uniform tone—snow fields, hazy views from aircraft or mountains, some seascapes—while differing considerably in reflectance, are likely to be rendered as though they had a reflectance of 12 percent, which is the integrated reflectance of the average outdoor subject. The result is underexposure for light-colored subjects and overexposure for very dark ones. Fortunately, such subjects are rare, and they can be recognized and allowed for.

The metering of very small objects is difficult by reflection—the object may not fill the meter angle. To compensate automatically for the scene variations, the Kodak Neutral Test Card (discussed in a later paragraph) can be used as a standard upon which to make readings with a reflected-light meter.

Precautions in the Incident-Light Method

It might be argued that the incident-light meter has no limitations because light-colored subjects should be rendered light, and dark-colored subjects should be rendered dark. It is unfortunate, however, that the photographic process does not do full justice to the brightness ranges found in nature. Therefore, better color pictures can be made by a shift in exposure if most of the subject is on the dark side, or if most of it is light. Thus, a judgment must be made of the nature of the subject matter if an incident-light measurement is used. We all recognize white as a light color and black as a dark one, but we tend to view all bright colors as having medium reflectance. They do not—bright yellow reflects two thirds of the light, bright blue less than one third. The usual half-stop decrease for light subjects applies to yellow subjects, and blue ones take the usual dark-subject increase. Scenes containing more than one important color usually result in exposure compromises. An exposure designed to obtain the best color fidelity from, say, bright green would wash out yellows.

The incident-light measurement disregards the effect of distance on shadow detail, or more accurately, the relative extent, importance, and darkness of shadow detail. In general, the smaller and darker shadow



details in distant views are not resolved by eye or camera and merge with lighter areas. When the subject is close, more details and darker shadow areas are resolved. The practical conclusion is that the exposure indicated by incident-light measurements for distant scenes or those without shadows should be reduced.

Field tests of incident- versus reflected-light measurements for color-film exposure in diffused daylight, particularly on overcast days, have indicated that reflected-light results are more pleasing. The incident-light technique is, however, extremely convenient for measurements of lighting contrast in various parts of the scene.

There is also the question of pointing the incident-light receiver in the right direction. More care should be used with flat cells than with convex ones. A flat-celled meter seems to give the most significant reading when pointed halfway between the sun and camera. This gives the main light, and therefore the highlights, the appropriate emphasis. Convex-cell incident-light readings of back-lighted subjects should also be made carefully, especially if the shadow details are more important.

Although good results can be obtained with incident-light measurements outdoors, it is questionable whether the results are any better than those obtained with reflected-light measurements.

Use of Test Cards

A reflected-light meter can be used to give what amounts to an incident-light reading by substituting a card of appropriate reflectance for the subject matter and making the measurement on the card. The gray side of the Kodak Neutral Test Card has a reflectance of 18 percent and matches the average reflectance of indoor subject matter. Since typical outdoor scenes have a lower average reflectance, ½ stop more exposure should be given such scenes in daylight than is indicated by use of the computer dial of the meter. The card should be aimed in the same manner as a flat-celled, incident-light meter, i.e., halfway between the camera and the sun. The use of a test card has, of course, the same limitations as an incident-light meter measurement in that it makes no allowance for unusually light- or dark-colored subject matter. There are two other precautions in using the card: the meter should be held close enough so that the card fills the field of view, and it should be aimed in such a way that no shadow falls in the meter field on the card.

With a Kodak Master Camera, 8 x 10, equipped with a 10-inch Kodak Wide Field Ektar Lens, John Bickel of Eastman Chemical Products, Inc., made this compelling photograph of a hydrocarbon cracking unit at Texas Eastman Company in Longview. Bickel exposed Kodak Ektacolor Film, Type S, for 1/10 sec at f/16 and printed the negative on Ektacolor Paper.

Calibration of Meter and Camera

With the newer American meters, all figures on the scale are accurate within a reasonable tolerance. Accuracies of a similar order are to be expected in lens-opening and shutter scales. For these and several other reasons, the color-film settings supplied in the film instruction sheets and the Data Sheets in *Kodak Color Films* constitute a basis for trial. Careful photographic tests should be carried out under typical conditions of use with the subject at least 8 times the focal length of the lens away to avoid the need for bellows correction. A series of exposures should be made, each differing by half a stop from the next. The mid-point of the series should be that indicated by the published exposure data or meter setting for the film. It is well to make several such tests on different types of subject matter. If these consistently indicate some value other than the published one, do not hesitate to adopt it. For example, if the best exposure seems to be ⅓ stop more than the recommended setting, then the next lower Exposure Index should be used for this meter, camera, and film combination. When another camera or meter is used, this new setting will not necessarily hold, and the setting recommended on the instruction sheet should be used for initial tests.

INCLUSION OF GRAY SCALE AND TEST CARD

WHEN color prints are to be made, a gray scale, such as that in the Kodak Color Separation Guides, included along the edge of the picture area, where it can be trimmed off the final print, will aid in the control of color balance in the reproduction. Most pleasing results are not necessarily obtained, however, when the scale is reproduced as neutral. The gray scale should receive the same amount of light, and light of the same quality, as the important parts of the subject. It should be placed at such an angle that there is no direct reflection from the surface of the card into the camera lens, and it should not be placed near colored objects which would reflect light onto it.

When Kodak Ektacolor Film is used, it is important that a neutral gray card having a reflectance of about 18 percent, such as the gray side of the Kodak Neutral Test Card, be photographed with the subject. As an alternative procedure, the card can be photographed on a separate piece of film of the same emulsion number, which is then processed with the film on which exposures of the subject have been made. The reproduction of the card is used to determine matrix exposures on Kodak Pan Matrix Film. The test card should be placed in the scene and illuminated with the same precautions which must be followed for the location of the gray scale as described in the previous paragraph.

COLOR-BALANCE INDICATORS IN DAYLIGHT

THERE are on the market color-balance indicators, or color-temperature meters, designed to analyze the color quality of various light sources and, from a meter calculation, suggest appropriate filters to balance the light source for the particular film used. Most of these devices are "two-point" meters, which indicate only the ratio between red and blue light. They are useful with tungsten light sources because the ratio of red to blue emittance in these lamps bears a consistent relation to color temperature. Neither the emittance characteristics nor the photographic effect of daylight can be reliably estimated from only the ratio of red to blue emittance. "Three-point" meters are better in predicting the effect of daylight on color film.

LENS PROBLEMS

TOP-quality color photographs are, of course, dependent on the use of top-quality lenses—lenses which minimize longitudinal chromatic aberration and lateral color, and lenses which are coated to reduce surface reflections, and thereby reduce flare light and spots. But, however fine a lens is, much of the quality obtainable from it can be lost by improper lighting. Remember that lens coatings do not eliminate flare, they merely reduce it. Dirt and oil on lenses tend to cancel the advantages of the coating.

Back- and side-lighted scenes, as well as highly reflective subjects, must be handled carefully to reduce flare. Surroundings not appearing in the picture should not be brightly lighted, because such areas are a frequent cause of flare. If the lighting on surroundings cannot be controlled, a very deep lens hood should be used. The lens flare caused by an indiscriminately lighted scene may not always be apparent on the ground glass, but the photographic results will be characterized by lowered contrast and color desaturation. On the other hand, flare can be created purposely by flooding a scene with light and using a light background. Such a scene produces a soft, pastel, high-key effect.

EXPOSURE IN TROPICAL REGIONS

IN general, the intensity of the light in tropical areas is approximately the same as that in temperate zones. Measurements made of the illumination level of the sunlight all over the world have shown that little difference exists between the temperate and the tropical areas under the same atmospheric conditions and with the sun at the same altitude in the sky. At 70° solar altitude, the total illumination from sunlight and skylight on a clear day is approximately 10,500 to 11,000 foot-candles for both tropical and temperate zones.

The impression is frequently held that more light is available in tropical regions than in more temperate climates. Several factors contribute to this erroneous impression. The lighting contrast is usually extremely high in tropical areas characterized by very clear atmospheric conditions. While, as a rule, the sun shines more frequently in such regions, the length of day is much less than at high latitudes in the summer. The subject material is also characterized by a great brightness range. Whereas in a few areas there is a great predominance of light-colored stucco dwellings and large expanses of white sand and coral, in most regions the tropical foliage is very dense and absorbs a great deal of the light. As a result, exposures must actually be increased above the normal value required in temperate zones for subjects outdoors in which considerable foliage appears.

Because the sun is more directly overhead for a longer part of the day in the tropics than in nontropical regions, the lighting tends to be strong top lighting. More supplementary lighting should be provided than is needed under the conditions of lower lighting contrast generally encountered in temperate zones. When no additional illumination can be provided for pictures made during the middle part of the day, about ½ stop more exposure should be used than is normally employed for average front-lighted subjects.

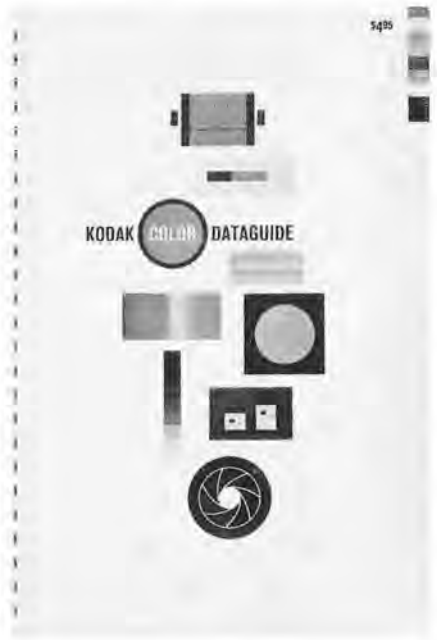
LOW TEMPERATURES

At the very low temperatures encountered in northern winters, arctic regions, or at high altitudes, the action of the shutter may be slowed down. If the camera is going to be used exclusively at low temperatures, the camera, or the lens and shutter assembly only, should be sent with an explanation to the manufacturer for cleaning and proper lubrication. When the camera is to be used again at ordinary temperatures, the shutter should be returned to the manufacturer for cleaning and proper lubrication for use at normal temperatures.

The effects of subzero temperatures on the speed and color balance of films are somewhat unpredictable. Experience has shown that both a loss in film speed of up to 1 stop and a shift in color balance must be expected under some conditions. The loss in speed and variation in color balance increase with lower temperatures, and their magnitude varies among the several color products. In general, however, these effects are not serious enough to require compensation. The reduced speed of the shutter at low temperatures does help to counteract the decrease in effective film speed.

in one tidy package, all the data you need to expose, process, and print in color

The Kodak Color Dataguide presents all the basic information you need to correctly expose, process, and print color pictures. Purposely, all theory and extensive explanation have been omitted; the material in this handy reference book is limited to basic descriptive and working data. The practical information for Kodak color products and processes has been collected, condensed, organized, and clearly presented in this Dataguide. Included are two computers, a gray card of 18 percent reflectance, a photographic gray scale, color control patches, a 35mm standard color negative and a sample color print, a set of six viewing filters, nine color reproductions on correcting poor color balance and exposure, and a unique filter-pack chart. Depending on your equipment and experience, you can choose from three complete color-printing methods.



OTHER COLOR DATA BOOKS

Color As Seen and Photographed. A readable explanation of the fundamentals of color and color photography. Describes how color processes work and how results are influenced by visual effects. Profusely illustrated.

Kodak Color Films. Contains full information on handling, processing, color balance and speed, use of filters, and related subjects. Includes a Data Sheet for each of the Kodak materials for still color photography.

Printing Color Negatives. Explains how to expose and process Kodak Ektacolor Paper to make color prints from negatives. Includes sections on dodging, contrast control, retouching, and prints from transparencies.

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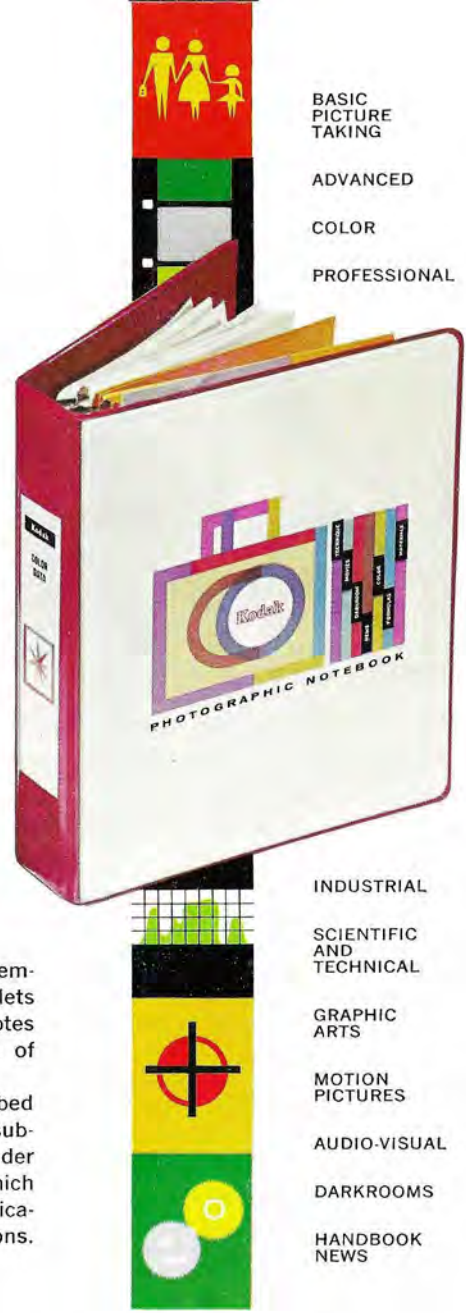

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